

**MASTER
NEGATIVE
NO. 94-82256-10**

COPYRIGHT STATEMENT

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials including foreign works under certain conditions. In addition, the United States extends protection to foreign works by means of various international conventions, bilateral agreements, and proclamations.

Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

The Columbia University Libraries reserve the right to refuse to accept a copying order if, in its judgement, fulfillment of the order would involve violation of the copyright law.

Author:

Edison Electric Light
Company

Title:

A warning from the
Edison Electric Light Co.

Place:

[New York]

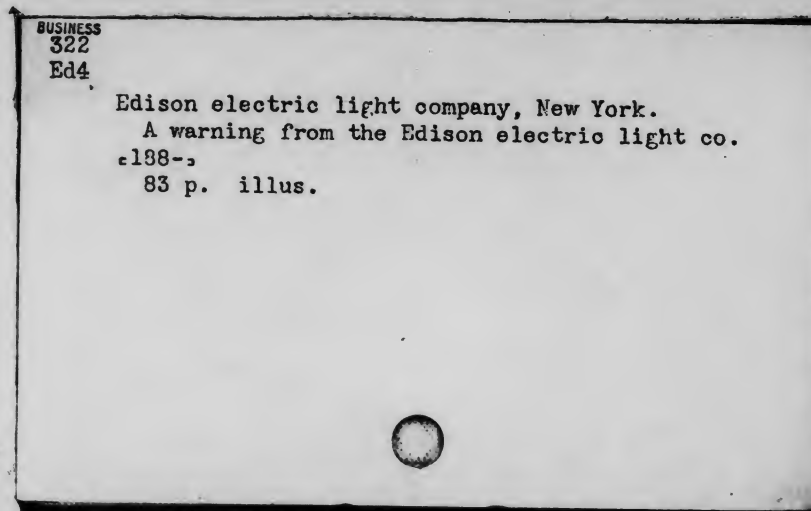
Date:

[1887]

94-82256-10
MASTER NEGATIVE #

COLUMBIA UNIVERSITY LIBRARIES
PRESERVATION DIVISION
BIBLIOGRAPHIC MICROFORM TARGET

ORIGINAL MATERIAL AS FILMED - EXISTING BIBLIOGRAPHIC RECORD



RESTRICTIONS ON USE:

TECHNICAL MICROFORM DATA

FILM SIZE: 35mm

REDUCTION RATIO: 2X

IMAGE PLACEMENT: IA IIA IB IIB

DATE FILMED: 10-20-94

INITIALS: DSP

TRACKING #: MSH 03031

FILMED BY PRESERVATION RESOURCES, BETHLEHEM, PA.

BIBLIOGRAPHIC IRREGULARITIES

MAIN ENTRY: Edison Electric Light Company

A warning from the Edison Electric Light Co.

Bibliographic Irregularities in the Original Document:

List all volumes and pages affected; include name of institution if filming borrowed text.

____ Page(s) missing/not available: _____

____ Volume(s) missing/not available: _____

☒ Illegible and/or damaged page(s): illustration preceding title page

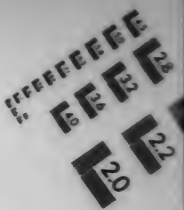
____ Page(s) or volume(s) misnumbered: _____

____ Bound out of sequence: _____

____ Page(s) or volume(s) filmed from copy borrowed from: _____

☒ Other: Illustration preceding title page filmed as found -- detached from text

TRACKING#: MSH03031



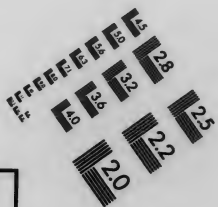
2.0 mm

ABCDEFGHIJKLMN OPQRSTU VWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

1.5 mm

ABCDEFGHIJKLMN OPQRSTU VWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

PM-MGP 13"x18" METRIC GENERAL PURPOSE TARGET PHOTOGRAPHIC



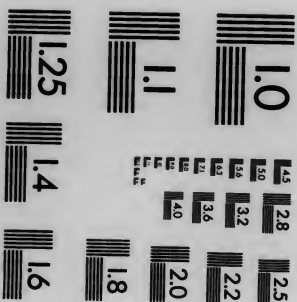
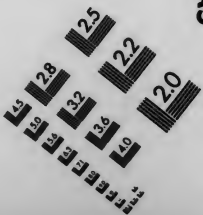
200 mm

150 mm

100 mm

A4

A5



ABCDEFGHIJKLMN OPQRSTU VWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

ABCDEFGHIJKLMN OPQRSTU VWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

ABCDEFGHIJKLMN OPQRSTU VWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

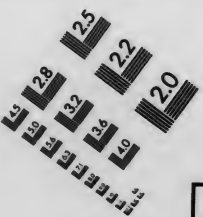
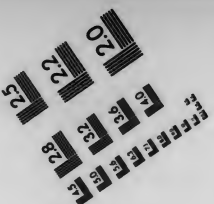
ABCDEFGHIJKLMN OPQRSTU VWXYZ
abcdefghijklmnopqrstuvwxyz 1234567890

1.0 mm

1.5 mm

2.0 mm

2.5 mm



1303 Geneva Avenue
St. Paul, MN 55119

PRECISIONSM RESOLUTION TARGETS

4.5 mm

3.5 mm

ABCDEFGHIJKLMN OPQRSTU VWXYZ

abcdefghijklmnopqrstuvwxyz

1234567890

ABCDEFGHIJKLMN OPQRSTU VWXYZ

abcdefghijklmnopqrstuvwxyz 1234567890



**A WARNING FROM THE
EDISON ELECTRIC LIGHT CO.**

D322

Ed4

Columbia University
in the City of New York

THE LIBRARIES



SCHOOL OF BUSINESS

REPUBLIQUE FRANÇAISE

MINISTRE DES POSTES ET DES TÉLÉGRAPHES

LE JURY INTERNATIONAL DES RECOMPENSES
DÉCERNÉ

Un Diplôme d'Honneur

M. SON (THOMAS A.)

ÉTATS-UNIS

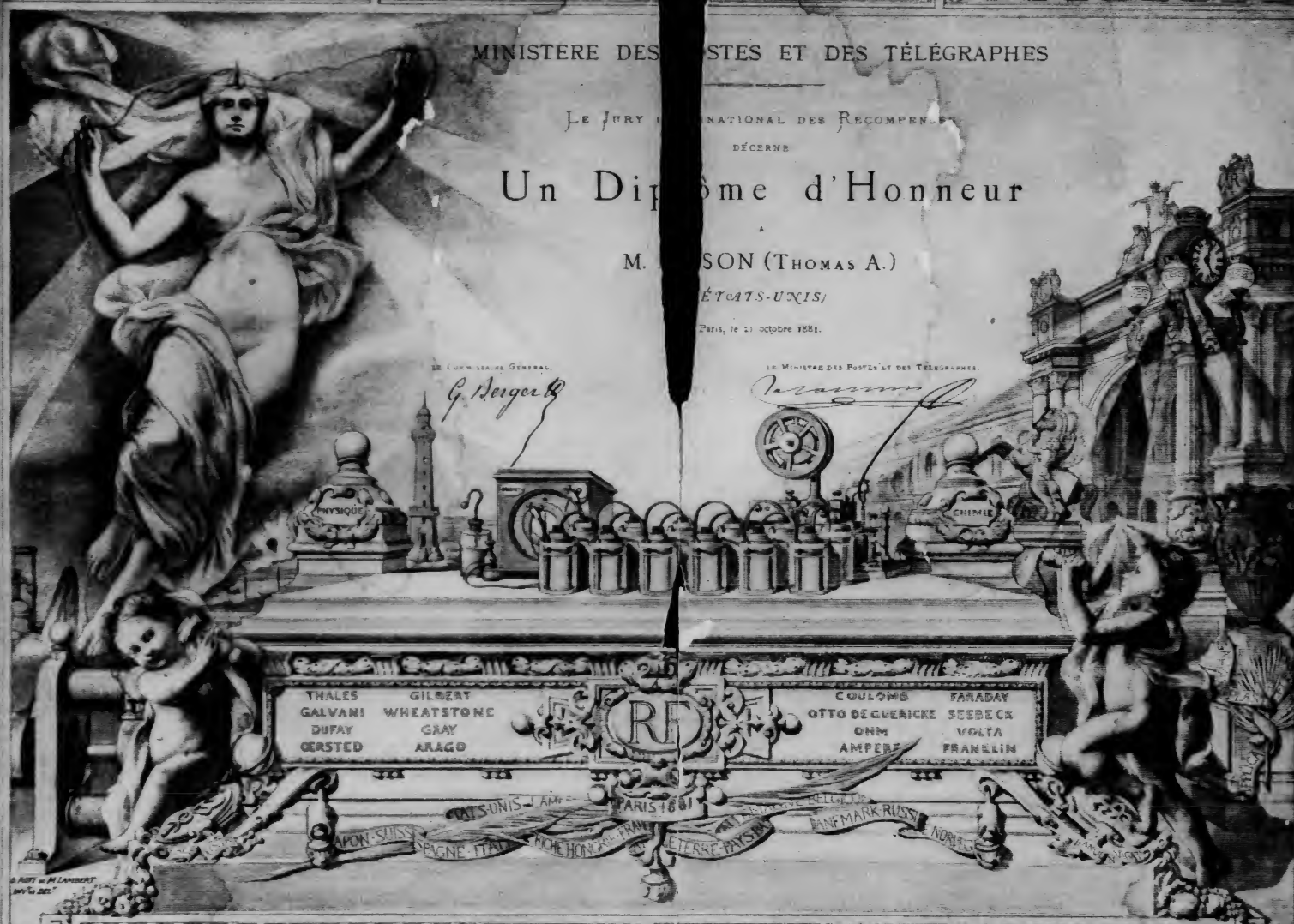
Paris, le 21 octobre 1881.

LE COMMISSAIRE GÉNÉRAL

G. Berger

LE MINISTRE DES POSTES ET DES TÉLÉGRAPHES

Paris



THALES
GALVANI
DUFAY
GERSTED

GILBERT
WHEATSTONE
GRAY
ARAGO

COULOMB
OTTO DE GUERICKE
OHM
AMPERE

FARADAY
SEEBECK
VOLTA
FRANKLIN

EXPOSITION INTERNATIONALE D'ELECTRICITE

ÉLÉMENTAIRE D'UN ANCIEN

A WARNING

FROM THE

EDISON ELECTRIC LIGHT CO.

COLUMBIA
UNIVERSITY
LIBRARY

Business

D322
Ed4

RECEIVED
YTD 11/10/11
YTD 11/10/11

NOV 8 1946 WS

A WARNING
from the
EDISON ELECTRIC LIGHT CO.

WHILE this Company has persisted in and will continue its policy of declining to be drawn into a controversy in the public prints upon matters which are the subject of litigation in the proper Courts of Law, it is nevertheless compelled at intervals to recognize, as an obligation to the general public, the necessity of *re-stating a few facts* which it is the constant effort of interested parties first to befog and then to deny.

The latest, most audacious and persistent effort in this direction is being made by the CONSOLIDATED ELECTRIC LIGHT COMPANY, at the instance of its new partners MR. GEORGE WESTINGHOUSE, JR., and THE THOMSON-HOUSTON ELECTRIC COMPANY. The mis-statements and misrepresentations put forth by these companies constitute our present apology for recalling the attention of the public to a card issued by us under date of May 24th, 1885, and supplementing the same by a few additional "cautions" which become applicable to the present situation by virtue of the injection therein, of additional sophistries designed to

confuse the minds of those who are only just now inquiring into the subject of Incandescent Electric Lighting.

By way of further preface to the card and remarks to follow, it may be observed that a consolidation of ownership of patents which are, of themselves, intrinsically worthless, does not add to their legal status or value nor to their commercial value. They are still intrinsically worthless and must continue so to be, though alleged millions of money and reckless audacity be massed behind them, save and except only to the extent that such a formidable phalanx may inspire the hope that the law may be evaded, and the *rich* infractor of the law may go unpunished whilst the *poor* man suffers.

To this hope, however, and by way of parenthesis, we give notice that in the instance in question the law is with those who are as abundantly able to command its protection as the others are to circumvent it. The following is a copy of the card referred to:

NEW YORK, May 24th, 1885.

THE EDISON ELECTRIC LIGHT CO.,

65 FIFTH AVENUE.

The EDISON ELECTRIC LIGHT COMPANY hereby gives notice to the public, as follows:

FIRST. That the patents of MR. THOMAS A. EDISON, now the property of this Company, fully cover the exclusive manufacture, sale, and use of any and all practical incandescent electric lamps.

SECOND. That the EDISON COMPANY having begun suits at law for the

enforcement of its rights under these patents will not relax in their vigorous prosecution.

THIRD. That the EDISON COMPANY is prepared to fully guarantee and protect all its customers, and to prosecute and punish to the full extent of the law, all makers, sellers or users of incandescent lamps not duly authorized by it.

The late attempt to establish for the Sawyer-Man patent, just issued, a fundamental character is made upon wholly superficial ground, and will not bear the test of close analytical examination. EDISON's patent of January 27, 1880, applied for at the time of his great discovery, covers broadly all the elements of that discovery, and is, therefore, fundamental and controlling. The Sawyer-Man patent, constructed in the light of the knowledge of 1885, but having for its foundation unsuccessful laboratory experiments, only covers certain details of manufacture of carbons, as for instance, paper and the specific genus of material to which it belongs, and is therefore secondary and subordinate. The claim that the Sawyer-Man patent is fundamental, simply because the narrow and valueless claim to the use of paper has been illegally and without notice to EDISON broadened to a claim for all fibrous material, carries its own condemnation. If anything more is necessary to demolish it, it may be stated that EDISON, SWAN, and others have already used material absolutely non-fibrous in preference to a material, the claim for which is now held to control the construction of a practical lamp. The public have nothing to fear from the use of the lamp as supplied by the original inventor and discoverer, while they render themselves liable for damages by the use of his fundamental patent for a "filament of carbon" if unauthorized by the EDISON COMPANY.

THE EDISON ELECTRIC LIGHT COMPANY,

By EDWARD H. JOHNSON,
Vice-President.

In his report to his stockholders ("Pittsburgh Despatch," Nov. 25, 1887) Mr. George Westinghouse, Jr., makes a deliberate misrepresentation concerning the above mentioned Sawyer-Man patent, in the following words:

"The incandescent lamp in its present commercial form is a modern invention, the title of which for a period of several years was fiercely contended for in the Patent Office by Thomas A. Edison and Messrs. Sawyer and Man."

This is absolutely untrue. The patent which covers the incandescent lamp, in its present commercial form, is the filament patent granted to Mr. Edison, which was not drawn into the controversy at all.

Mr. Westinghouse also says:

"In the meanwhile, the Sawyer-Man invention was patented in England. The Edison Company bought this English patent through an agent, brought suit on it and sustained it, and thereby obtained in England a substantial monopoly of electric incandescent lighting."

This statement is false in every particular, the fact being that the Edison Company in England brought suit on Mr. Edison's *filament patent* and sustained *it* and *thereby* obtained a monopoly.

The method or improvement claim to which Mr. Westinghouse alludes was *never* the subject-matter of an interference between Edison and Sawyer-Man in the U. S. Patent Office. It was *not* bought by the English Edison Company but by the English Swan Company—then an entirely separate organization—and became the property of the English Edison-Swan Co., only by virtue of the consolidation of those two interests. It was, among other patents, made the subject of a suit in the English Courts and together with Edison's fundamental filament patent was sustained. The English Co., however, did not *thereby* and in consequence of *it* obtain its monopoly; *that* monopoly it obtained directly and solely in consequence of the decision sustaining the fundamental Edison filament patent. In complete corroboration of this statement we have the fact that the so-called fundamental Sawyer-Man method is *not even used* by Edison in the manufacture of his incandescent lamp whereas it is *impossible to construct any lamp* of commercial utility *without employing Edison's filament of carbon*.

SUFFICIENCY OF PENDING SUITS.

It is evident that Westinghouse, Thomson-Houston and the Consolidated Company (Sawyer-Man) have adopted a concerted programme to give the impression that the various suits which the Edison Company have been vigorously

pushing on its lamp patents for nearly three years, and on its three-wire patents for over a year (which was about the date of their first infringement), do not control the question of infringement of those patents by the consolidated concern, and that the question of such infringement can be determined only by separate suits against them, and that they are eager to have such suits brought. *In point of fact a decision in any of our pending suits against one infringer will practically be a decision against all*, the law itself affording summary remedies to enforce the decision wherever it will apply as soon as it is granted. As the trial of an important patent suit easily involves a cost of one, two, or more hundred thousand dollars, the impossibility of instituting and pressing exactly parallel suits in each separate case of infringement, or against each separate infringer, can be readily understood; furthermore, the practice and comity of the Federal Courts obviate all necessity of such a course. The Thomson-Houston Company, therefore, in asking us to institute new suits against them on the questions involved in our previous suits against other infringers, or the Consolidated Company, in bringing a suit against the Cumberland Edison Company, are not exposing themselves to any new risk or asking us to do anything more than we were already practically doing. Their motives are doubtless to create the false impression that they are not, for all practical purposes, included in our pending litigation, and that they are eager to have separate new suits brought, in order to facilitate the reaching of a decision on the questions at issue. They apparently would also have the public infer that the questions at issue are different or less supportable than those at issue with the other infringers. In point of fact they are identical. The Edison Company is litigating on fundamental patents, and a decision in one case and against one infringer will, as stated already, determine its rights against all. Hence the mere multiplication of suits can serve no purpose other than to weaken our position by diffusing our strength, which is doubtless a part of their programme.

In August last the Edison Company received from the Patent Office, after seven years of delay, a patent on central station distribution, so broad in its character that, as the Thomson-Houston Company well say in their circular, it will not only control them, but, "if it can be substantiated at all, will have a like controlling and embarrassing effect upon every other company in the field seeking to do incandescent business" (see Appendix A). Upon the issue of this patent, suit was started against The New Haven Electric Company (a so-called Thomson-Houston licensee), that company being selected because of its presenting a clear case of infringement of some of the principles involved, but, as the Thomson-Houston Company themselves admit, a decision in that suit will have "a like controlling and embarrassing effect upon every other company in the field seeking to do incandescent business." So will a decision on our lamp patents, and so, to the extent of the questions involved, will a decision on our other patents.

We think we have shown that our pending litigation applies to all; and the attempt of the new combination to deceive the public by creating an inference that they or any of their members can escape the decision given in these suits, or in any of them, or that there are other questions involved as against them, which can be reached only by separate suits which the Edison Company is unwilling to start, is dishonorable in itself, and may further serve as an illustration of the methods which the Westinghouse, Consolidated (Sawyer-Man), Thomson-Houston combination find themselves forced to adopt in order to appear to the public as a formidable rival of the Edison Company in the Courts and in the commercial field. There being no foundation, in fact, for their pretensions, they are compelled to construct one in fiction. Doubtless, since the field of fiction is a large one, and temporarily fruitful, opponents may continue exploring it; but, as "truth is mighty and must prevail," we shall henceforth, as in the past, content ourselves with only an occasional appearance by way of cautioning our friends, and the public in general, against a too ready acceptance of future statements from the above-mentioned sources.

CAUTION 1. PATENTS.

Incandescent electric lighting throughout the world is founded upon the inventions of Mr. Thomas A. Edison, to whom patents were granted therefor in all patent granting countries of the world. One of these inventions is broadly claimed in the U. S. Patent No. 223,898, dated January 27th, 1880, application filed November 4, 1879, in the following words:

"An electric lamp for giving light by incandescence consisting of a *filament of carbon of high resistance*, made as described and secured to metallic wires as set forth" (see Appendix B).

This claim has been litigated three times in Germany and twice in England, and been sustained in both countries each and every time. Suits on it have been brought and are now pending in the U. S. Courts against the Consolidated (Sawyer-Man), the United States and The Brush-Swan Companies. These suits are being vigorously and carefully litigated with every evidence of an ultimate issue as satisfactory as that obtained in Europe (see Appendix C).

The lamp covered by the above-mentioned patent is the *key* to the entire industry of incandescent electric lighting.

The invention and the claim which describes it have never been the subject-matter of interference in the Patent Office, the more or less direct and inferential assertions of the various parties to the "combination" to the contrary notwithstanding.

Furthermore, the patent itself is of *prior* date to the worthless claim on paper carbon which *was* in interference with Edison and which constitutes in large part the treacherous foundation of the hope of the combination.

Assuming, therefore, for the sake of more clearly defining the status of the Edison Company as contrasted with that of its notorious infringers, that the patents of both interests be sustained in their broadest sense, the relative position of the two would be as follows: The Edison Company would simply be compelled to make its filament

of *non-fibrous* material—a material, by the way, from which hundreds of thousands of commercial lamps have already been made. The “combination” would be unable to use the fundamental *filament* at all, and therefore would possess, even if their claim were maintained, merely a subordinate improvement, under which they could make no lamp.

Thus we see that, *in any event*, Edison possesses the *keystone*, but it is of equal importance to *note the fact* that the entire *arch* was his invention and that it is secured to the Edison Company by a patent as broad and comprehensive as was ever issued by the Patent Office of the United States. We refer to the patent which protects his *system of electrical distribution* (see Appendix D). Those familiar with the history of the invention will readily recall the furor created by Edison's announcement, not that he had discovered how to obtain electric light by incandescence (that was old), but that he had succeeded in sub-dividing the electric current by a *practical application* of incandescence. True the *practical application* involved a new departure in incandescent lamps, viz.: A filament or thread of carbon of high resistance, which invention covers the modern incandescent lamp, but the filament lamp was only a part—though an essential part—of the whole problem of subdivision. It will be remembered that the above announcement, though received with implicit faith by the great body of the lay world, was, by the professional element, absolutely denied credence. The technical world contradicted, ridiculed and proved by mathematical formulæ, Edison's claim to be an impossibility; nevertheless, Edison's discoveries remained and were attested before the world by the Paris Electrical Exposition of 1881, and Mr. Edison was then and there not only granted a diploma, but was also advanced from a *Chevalier* to an *Officier* of the Legion of Honor, as a further mark of appreciation of his great work (see Appendix E).

The Patent Office of the United States, in granting Mr. Edison a broad patent on the comprehensive system thus recognized by the learned scientists of Europe, exercised such caution and hesitancy as to allow the patent to issue only after the lapse of seven years, during

which period the several principles and methods enunciated and claimed in the patent have come to be established as fundamental and controlling, to such an extent as to extort an outcry against the patent *on the ground of its very comprehensiveness*. The fact that its claims were drawn seven years ago when their meaning and value was known and realized only by the inventor is now overlooked, but the very phraseology of the patent itself discloses and emphasizes its *original* and *historic* character, and carries conviction as to its *equity*. Its *legality* will be taken care of by this company in due course (see Appendix A).

This patent, therefore, constitutes the *arch* and the filament patent the *keystone* of the industry of incandescent electric lighting. *Both the arch and the keystone* must be declared public property by the courts ere Mr. Edison can be safely deprived of his just right to that reward for his great services, which is the object and motive of a patent.

The industry offered to the public by the Edison Company does not therefore depend upon a single issue; for quite apart from the filament patent, the enterprise is abundantly protected by the “system” patent; and quite apart from either or both of these, the detail patents owned by this company, numbering some hundreds, and all bearing date as of the pioneer epoch, suffice to debar others from a free appropriation of our property. The system patent in question is No. 369,280, dated Aug. 30, 1887, application filed Feb. 5, 1880 (see Appendix D).

Numerous other patents forming the subject matter of some *hundred* and odd suits now pending, likewise and additionally hedge about and protect the industry of incandescent electric lighting (see Appendix F).

Both the seller and the *purchaser* of incandescent electric lamps, apparatus, or systems of electric distribution for incandescent lighting, are hereby *admonished* and *warned* that they become subject to, and will be held in damages for, all violations of any of the above patents. Such result has been achieved and *damages been*

awarded to Mr. Edison in Europe, as they most certainly will be in this country, when the law's delays shall have been finally overcome (see Appendix G).

VALIDITY OF PATENTS.

The position taken by the infringers of the Edison Company's lamp patents is founded upon the assumption that those patents have met with a premature death by virtue of the supposed expiration of foreign patents; that this position is a fallacious one and has no foundation in fact, we not only most emphatically assert but present in support of our assertion the following opinion of most eminent counsel:

New York, Dec. 28, 1887.

DEAR SIR: Pursuant to your request we have carefully examined the Letters Patent of the United States owned by your Company and issued upon the inventions of Mr. Thomas A. Edison, relating to incandescent electric lamps, with the view of advising you as to whether such patents are limited or affected by foreign patents covering the same inventions, the said foreign patents being subsequent to the date of the applications upon which the United States patents were issued.

After this examination and considering attentively the statutes bearing on this point and the judicial interpretation of them, we have no hesitation in giving our opinion that the United States patents referred to are in no way limited or affected by such foreign patents, but are severally valid for seventeen years from their respective dates and that they will be upheld to this effect by the Supreme Court of the United States whenever the question shall be presented for its decision.

Yours respectfully,

WM. M. EVARTS,
CLARENCE A. SEWARD,
JOHN C. TOMLINSON.

To EDWARD H. JOHNSON, Esq.,
President, &c.

CAUTION 2.

FUTILITY OF GUARANTEES.

As against the warnings of the Edison Co., its opponents proffer with great prodigality guarantees of all sorts. They will freely guarantee immunity from damages as well as the superiority of their wares on all points.

Let us investigate these guarantees.

NATURE OF GUARANTEE.

- 1st. Guarantee of patents offered.
- 2d. Guarantee against damages for infringement of patents of others.
- 3d. Guarantee of specific results from a given power expended—with accompanying guarantee of life of lamps.

FORM OF GUARANTEE.

- 1st. Guarantees given by corporate bodies.
 - 2d. Guarantees given by individuals.
 - 3d. Guarantees accompanied by collateral security.
- We will consider them in the order named.

1st. To guarantee a patent is to guarantee its validity, *i. e.*, to pre-determine the action of the Courts of last resort. This is an absurdity and a business folly of which only wholly irresponsible and unscrupulous concerns would be guilty. That is to say, no one can guarantee the final action of the Courts.

2d. To guarantee *against* damages for the infringement of a patent held by others is a business risk; and as such it should (to be of any avail) possess a value equivalent to the aggregate of all possible damages.

3d. To guarantee specific results for the purpose of establishing superior economy, it becomes necessary to take account of all the factors incidental thereto, as for instance:

- A. The effective candle power obtained per horse power expended.
- B. The loss of energy between dynamo and lamp.
- C. The life of the lamp itself.

If one of these factors be absent the remainder may be readily made to bolster a dishonest guarantee.

IMPRACTICABILITY OF PROVING GUARANTEES.

To measure accurately the horse power expended by any given motor is a task of such delicacy as to tax the resources of trained experts and jurors of awards in industrial expositions.

To measure accurately the candle power obtained is even more difficult and requires elaborate apparatus with surrounding conditions impracticable, since it is essential that the measurement, to be accurate, must be made with the lamps in the position of their designated use, otherwise the loss in the conductors and intermediate apparatus is not taken into account.

To obtain the life of lamps the element of time must be introduced, since they are guaranteed to average a given number of hours of burning at a rated candle power.

This, of course, precludes an immediate determination as to their proper performance, and even an ultimate determination in this respect is surrounded with difficulties, since the guarantee of lamp life is invariably accompanied with qualifications as to the proper regulation of the electric pressure, &c., &c.

The difficulties attendant upon the separate determinations of candle power, horse power and lamp life, become greater when, as is absolutely essential to an honest test, they are made at one and the same time. It will be observed that unless the measurements of power expended and candle power obtained are made simultaneously, they are without value; and further, that unless the lamps employed in the test are such as are designed to come within the guarantee as to life, the test will be without meaning, for the

reason that it is entirely feasible, and we fear often the practice to, make an economy test with a high economy lamp of short life especially provided for the purpose, subsequently substituting therefor a lower economy lamp with a life which will substantiate the guarantee given for it.

In short, a guarantee of economy involves such complications as practically forbid the detection of dishonesty; hence a guarantee of economy is simply a matter of what the leading and most reputable company will do; the others will promptly "offer even better" without reference to, and often without knowledge of, their ability to perform. In evidence of this, note the fact that all the so-called competitors of the Edison Co., have invariably guaranteed a small percentage more than that company and just as the development of the Edison lamp justified an advance of its *guarantee*, the guarantees of others have advanced. Does any one suppose that this coincidental and universal development has been a fact? No; it means simply as we now point out, that *anything* may be guaranteed since detection is impracticable (see Appendix H).

VALUE OF VARIOUS FORMS OF GUARANTEES.

Guarantees by corporate bodies possess just that measure of value which is the standing of the corporation itself. If it is a *bona fide* organization with character and capital, then its guarantee becomes of a par with that of individuals of like repute. Otherwise it is not worth the paper upon which it is written. Assuming, however, that the guarantee is given by a reputable concern we will class it with, and consider it, in the next following category.

In considering guarantees given by individuals, it is useful to deal only with those of individuals who have rank in the commercial world. Our inquiry, therefore, is as to the sufficiency of a guarantee over the signature of a man whose private fortune is supposed to be large and whose pecuniary responsibility is not questioned; the value of a guarantee of such an one, in the matter of the quality of the goods he supplies, is only dependent upon the ability of the ag-

grieved party to prove short measure. This ability we have shown is only present with the purchaser in a meagre way. He can demonstrate gross failure only. He cannot detect the absence of that "superior economy" a guarantee of which induced him to buy of the guarantor and yet instead of possessing 10 or 20% higher economy his plant may and very likely does fall that per cent. short of the economy of the plant rejected. This, however, is of minor importance as compared with *the efficacy of the guarantee as against damages for infringement of patents*. Such liability is not dependent upon elaborate and complicated measurements, but is the direct result of an edict of a Court of law. It is, therefore, one which must either rest upon the guarantor or the party guaranteed.

ON WHOM WILL DAMAGES FINALLY FALL?

We assert that they will fall upon the *purchaser* of the electric plant, and for this reason: the very responsibility of the party making the guarantee brings him numerous customers, *all of whom* receive like guarantees. These in the interim of the patent litigation aggregate vast sums. The larger and more prosperous the business of such an one the heavier the aggregation of responsibility, and the less the value of the guarantee. No private fortune, however great, would in the event of award of damages avail, *even* if it was not employed to evade by technicality such great responsibility. The one thing certain in such event would be that the guarantee would be unavailable and the user not only be *compelled to pay* but also to *cease the use of the infringing apparatus*.

Guarantees accompanied by collateral security are therefore the sole guarantees of value as against the holders of a patent of prior date and fundamental in its character. Such guarantees are of course practically out of the question save in a few exceptional cases where the object of the guarantor is something more than the mere sale of goods; it is useless therefore to consider them in the discussion of a purely commercial question. In such transactions they would not be given.

Finally we must conclude that guarantees in patent matters do not guarantee. The *only assurance* of practical value is to deal with *original owners* who can show *fundamental patents of prior dates*, and whose business is conducted *with special reference to a future* rather than a present profit, thereby establishing by the strongest proof not only their original and fundamental ownership, but confidence in their ultimate control of the industry.

CAUTION 3. INVESTMENT.

CENTRAL STATION ELECTRIC DISTRIBUTION.

Before investing his money, a prudent man will inquire as to the character and scope of the enterprise in which he contemplates embarking.

In this connection attention is called to the fact that the term "Electric Lighting" is so wholly inadequate as a description of the *industry of manufacturing, distributing and selling* electrical energy, as to be misleading in the extreme.

Any "system" which is available only for the single purpose of lighting is necessarily so heavily handicapped, as against a system which is capable of universal adaptation, as to be practically out of the race.

It is imperative, therefore, that the intending investor shall inquire as to the adaptability of the system presented to his notice, to all the requirements of the community which he desires to serve, as for instance: Light, Power, Heat, Ventilation, and the manifold industrial and other uses to which electricity is now being applied with phenomenal rapidity.

To the end of directing the inquirer intelligently we will endeavor to indicate of what and how such a universal system is constituted.

A universal system must possess the following elementary components:

- 1st. A continuous current in one direction.
- 2d. Uniform pressure.
- 3d. Maximum of safety.
- 4th. Absolute reliability.
- 5th. A practically unlimited supply.
- 6th. Minimum cost.
- 7th. Means of measuring.
- 8th. Complete control by the user of the energy supplied to him.

It will be readily admitted that any system possessing these elements must inherently possess that mean of simplicity and elaboration, which in any industry can alone give a resultant of satisfaction to the producer and the user.

The element of simplicity must pervade not only the individual unit but the entire system, whilst elaboration must go to the extent of providing means for securing the essential conditions of a perfect service.

In electrical distribution these essential conditions are as follows:

- 1st. Subdivision of generating units to secure reliability and economy of production.
- 2d. Meshing of distributing conductors in a common net-work throughout the entire area supplied to secure uniform distribution.
- 3d. A system of special feeding conductors to apportion equally the supply of energy to the demand throughout the area of the system of conductors.
- 4th. A system of indicators to denote variations of pressure at any point in the area of consumption.
- 5th. A system of regulation to compensate for any variations of pressure (see Appendix D).

It will be observed from the foregoing that our investor needs to enquire for **an economic and reliable system of electrical distribution**, and not simply for a method of electric lighting, or a method of electric power, or a method of electric heating, or a method of electric signalling, or a method for any other specific use. He wants *a system which shall comprehend all these* (see Appendix I).

It is only from the use of such a system that he can derive the full measure of return upon his investment, and thereby secure himself a practical guarantee against competition.

Having now cast an introspective glance at the field which he would occupy, and learned the means whereby it may be satisfactorily accomplished, it behooves him to inquire as to which of the Electric Companies bidding for his favor, the most nearly approximates the requirements of the situation.

To enable him to do this we will provide an analysis of the methods adopted and recommended by the various Electric Companies, and indicate to him wherein they severally succeed or fail to fill the bill.

DIRECT CURRENT METHODS IN WHICH THE INVESTMENT IN CONDUCTORS IS MINIMIZED BY THE USE OF HIGH PRESSURE.

This idea has been advocated principally by the various Arc Light Companies. Hundreds of plans, methods, devices and compromises, under the generic terms of "series," "multiple series," "distributing" devices and various compoundings thereof, have been tried and found lamentably wanting.

They have one and all utterly failed for the simple reason that the translating unit, *i.e.*, the lamp, the motor or other device, *loses its individuality* in consequence of deriving its current *through another like unit*. One discontinued, either discontinues the other, makes it necessary to substitute an unproductive but current consuming unit for that discontinued, or throws upon the accompanying unit additional work, thereby affecting disastrously both its life and its economy.

The employment of high tension currents is furthermore objectionable on account of their unreliability and of being fraught with danger to life and property to such an extent as to be discouraged by Fire Boards and others having these things in keeping (see Appendix J).

This method has in fact nothing to recommend it but the one item of minimizing investment in the conducting wires. It is a cheap make-shift only and possesses no element of permanency.

It is furthermore incapable of filling even a small fraction of the essentials of a comprehensive system in that it can be applied to but few practical uses. It may, therefore, be dismissed by us as it has been by that part of the public who have tried it both in the capacity of investors and consumers.

If further proof is needed of the uncommercial character of this compromise between judicious investment with its accompanying practical and financial success, and parsimonious economy, with its resultant of practical and financial failure, it is readily found in examples still extant, as, for instance, the Hotel Brunswick in this city, with its several hundred lights lit up *en masse, hours before they are all required*, or even useful, and maintained an equal period after the *great majority are no longer needed. Some one pays for this useless lighting.* Or if this is not sufficiently convincing, note the present strife and acrimonious controversy among the companies heretofore employing this method over the last sensation in the way of *high tension* compromises, viz., the so-called

"GOULARD & GIBBS' WESTINGHOUSE ALTERNATING CURRENT CONVERTER SYSTEM."

Having become convinced that for permanent investment the direct current high tension system offers no inducement, our inquirer naturally turns to its *successor in the high tension line.*

The alternating current high tension with its converting (reducing) apparatus, like its predecessor, aims at minimizing investment in the conducting wires by employment of the high tension currents, and, as we shall presently see, with the same or even more unsatisfactory results.

An alternating current, *i. e.*, a current changing its direction several hundred times per second, is employed simply because it affords a simple and ready means of effecting a reduction of the *high pressure* employed in the street wires to the *low pressure* demanded by the lamps in the house systems. The advocates of this system claim that in it they have the advantage (?) of the economy of high tension combined with the essential requisite of low tension, and, therefore,

theoretically, the perfect system. Let us see if it sustains this claim in practice.

The employment of alternating current generating machines forbids the harnessing together of *two units* or more on one circuit; hence, the reliability and current capacity of that circuit is only that of a single machine. The alternating current forbids the use of economic *motors*, hence, *power distribution is impracticable*, and the system is thus seriously limited in its scope. For a like reason, many other applications, such as electrolysis, electro-plating, &c., are prohibited.

Since the destructive effect, either upon life or property, is enormously enhanced even by the interruption of an ordinary current traversing it, it follows that the complete *reversal* of the current causes it to assume the form of a real danger. Note the precautions and restrictions demanded by the Fire Board in their rules and regulations and the justification thereof in the deaths already caused by this system, although it has but just come into the field. Furthermore, its effect upon the adjacent wires of other electrical enterprises, as, for instance, the telephone and telegraph, is disastrous. Note the suit of the New Orleans Telephone Company to restrain its use in proximity to their wires (see Appendix K).

The large engine unit requisite, the low economy of the generator, as compared with the direct current dynamos, the extraloss of energy due to the interpolation of the converter and the constant demand upon the station made by the converters, irrespective of the work they are doing, all combine to render the system the most uneconomical yet offered to the public. But, to the end that the absence of the main essentials of a perfect system may be made more apparent, we will before proceeding refresh our inquirer's mind as to the essential components of a perfect system by an examination of the salient points of

THE EDISON DIRECT CURRENT LOW TENSION SYSTEM.

A continuous current always flowing in the same direction, and of the pressure required by a single lamp is made to suffice for an illimitable number of lamps, motors or other devices,

and by virtue of these characteristics, the current becomes applicable to *every use to which electricity is now or may be applied*.

It furthermore does not injuriously affect (whatever its pressure) adjacent electrical service, such as telephone or telegraph systems, which services are seriously impaired by currents of interrupted or alternative character.

A uniform pressure is essential to a uniform lighting, mechanical or heating product; hence its importance cannot be over-estimated, and in this system a uniform pressure is treated as a prime factor.

A maximum of safety is obtained in part by the employment of comparatively low pressure, and in part by innumerable devices especially and originally designed therefor, as well as by virtue of the high standards of material, workmanship and methods employed in their construction and application.

Absolute reliability. This desideratum is obtained by a complete subdivision of all the several units employed, whether boilers, engines, dynamos or conductors, thereby relying in no respect upon a single thread, but so weaving all into one common web or network as to render the failure of any one or more a mere matter of a momentarily reduced aggregate product, insufficient in itself to effect the extinction of even so much as a single lamp or other consuming unit, or, in fact, to make itself apparent to a consumer in any way whatever.

A practically unlimited supply. This important requisite to a system that aims to meet *all demands* is obtained by the meshing of conductors in a common network, thus permitting the current to flow toward a point of extraordinary demand from any and all directions and consequently availing of the law of general averages, viz., the interchanging of idle and active units. This interchangeability likewise results in a uniform general demand on the station notwithstanding that scattered consumers may be drawing upon it extraordinarily. The supply thus becomes for all practical purposes unlimited, inasmuch as ample notice and time is thus obtained to increase or diminish the supply at the station.

Minimum cost of production. This commercial factor

is present in the system by virtue of the fact that each and every producing unit, itself of the highest efficiency, is only employed in the direct ratio of the consumption of its product, and further, by reason of the fact that no translating, converting or other energy-consuming apparatus intervene between the generating and the consuming units to waste a material percentage of the energy.

Means of measuring the quantity consumed.

Without accurate apparatus for determining the precise measure of energy used by the consumer, it is evident that no true commercial relation can exist between producer and user. Either one or the other will obtain an undue advantage however honest may be their intentions. The Edison system is unique in this respect. It is the only system possessing a meter which has been demonstrated by years of practical and commercial use to be accurate and reliable.

The complete control by the user of the energy supplied to him is of paramount importance, since thereby only, can he call it into use when, and to what extent, and for what purpose he may wish, and, *per contra*, determine that use. This exceedingly important feature has received in the Edison system thorough treatment and practical development in the numerous uses to which electricity is applied (see Appendix L).

Having thus reviewed a "system" (because of its comprehensive character worthy of the title), let us place in juxtaposition a few examples illustrating the relative economy of operating and first cost of the **Edison Direct** and the **Westinghouse Indirect or Converter System**.

Both systems start from the coal pile; both employ steam boilers and engines. The Edison Direct system requires no apparatus between the dynamo and lamp; the Westinghouse Indirect System interpolates pressure reducer; the Edison Direct System permits of the use of a self-exciting high economy generator; the indirect system demands an uneconomical generator with supplemental magnetic exciting apparatus. For example (employing only such efficiency figures as are a matter of record, which are, therefore, not dependent upon mere asseverations):

Assumed a station doing commercial lighting from 4 P.M. until 7 A.M.

	DIRECT SYSTEM.		INDIRECT SYSTEM.	
	Commercial Efficiency.	Loss.	Commercial Efficiency.	Loss.
Dynamo.....	90%	10%	70	30
Mean loss in conductors for 15 hours run.....		4.7%		0.5%
Mean loss in transformers for 15 hours run (maximum efficiency 96%).....				4.8%
Totals.....		14.7%		35.3%

Difference in favor of Edison, 20.6%.

This estimate does not take into account the losses in the distributing conductors—that is, the service conductors from the converters to the houses—nor does it include the house wiring itself, which system of subordinate conductors requires a much larger amount of copper for a given number of lamps than does the Edison on account of the lower electrical pressure employed by their lamp, viz: 60 units as against 110 in the Edison lamp.

Further, this estimate is based upon a nearly perfect converter, whereas such converters are so expensive that to obtain the essential reduction of cost, cheaper and less efficient converters will be and are employed. Such cheaper converters possess only about half the economical efficiency of the more expensive ones, involving a loss of nearly 10% instead of the 4.8% we have allowed.

Thus it appears that the economy of the indirect, as of all other high tension systems, is sacrificed to an effort to minimize investment. Now, let us see if that effort is realized. Boilers, engines, dynamos, etc., may for all practical purposes be considered as costing per initial horse power, the same in each system. This leaves the con-

ductors alone in which to find an opportunity for reducing the investment.

FOR EXAMPLE.

Given a problem—say the actual delivery of 10,000 lamps—we obtain the following:

INVESTMENT.

DIRECT SYSTEM.	INDIRECT SYSTEM.
Copper sufficient to supply 10,000 lamps with low pressure. (See Appendix M.)	Copper to supply 10,000 lamps with high pressure, <i>plus</i> cost of converters to reduce to low pressure, <i>plus</i> 20.6% extra H. P. in boilers, engines, dynamos and converters <i>to make good</i> the shortage of 2,000 lamps, sacrificed to minimized investment by false economy.

Our investor needs but little mathematical ability to satisfy himself that the saving is chimerical; that the economy does not exist, that the adaptability is absent; that, in short, the elements of reliability, safety and general utility are in the indirect as lamentably wanting, if not more so, as in the preceding efforts to employ high tension.

Capital is, and should be, conservative. When seeking investment, it must consider the elements of permanency, fitness, economy and safety. The Edison low tension system alone offers these. All others are simply "catch penny" devices for ensnaring the unwary, put forth by "Cheap Johns" "the Apostles of Parsimony" who would have our investor believe the Edison system one demanding undue and unnecessary capital because, forsooth, that system is offered only upon terms and conditions legitimately demanded by sound investment.

CAUTION 4.

DANGER.

Human life is endangered by electricity only when the electric pressure employed is sufficient to overcome the resistance offered by the body. Testimony on this point has been taken by a Committee of the British House of Commons and 250 to 300 units was determined upon as the safe limit; such eminent electricians as Sir Wm. Thompson, Dr. C. W. Siemens, Dr. John Hopkinson and others fully concurring in this conclusion.

It is a matter of fact that any system employing high pressure, *i. e.*, 500 to 2,000 units jeopardizes life.

Furthermore, since the function of high pressure is to overcome resistance, and since *insulation* is only another name for resistance, it follows that high pressure demands extraordinary precautions in the matter of insulation, and even when so guarded occasionally escapes with disastrous consequences; *vide* all Electric Lighting rules and regulations of Fire Boards and the many authentic cases of loss of life, from all of which it is a self-evident proposition that excess in this direction means greatly enhanced risks to life and property. (See Appendix P.)

Any *interruption* of the flow of the current adds to its destructive property, whilst its complete reversal, as in the Alternating (Westinghouse) system increases this destructiveness enormously.

It is therefore clear that high pressure, particularly if accompanied by rapid alternations, is not destined to assume any permanent position. It would be legislated out of existence in a very brief period even if it did not previously die a natural death (see Appendix K).

In confirmation of these deductions we have the fact of frequent and altogether unnecessary loss of life in Europe as well as in the United States due to the employment of high tension by the advocates of cheapness, and we now have the ratio of disasters multiplied

and increased by the introduction of that still more dangerous practice, the alternating or reversal of an already dangerously high tension current.

As against the death record of the high tension systems which, if it stood as truly representing the measure of safety accompanying the use of electricity, would unquestionably condemn it, we have the glorious record *of the Edison low tension system, from which there has never been a single instance of loss of life from the current employed.* Furthermore, an important fact in relation to the employment of the high tension alternating current must not be overlooked. The present practice is to place the pressure reducer upon the poles or other external fixtures, thus allowing only the low tension current to pass to interiors. But its advocates are already strenuously seeking to overcome the opposition of the Insurance Underwriters, and to place the converters within the premises of the consumers, thus bringing the dangerous element to the interiors; nor must the fact be concealed that the slightest defect in the insulation of the converter will permit of the transfer of the high tension employed in the street circuits to the low tension circuits employed in the houses, even though the converter be itself placed in the open air.

Examples of this insidious conveyance of the known dangerous external force to the supposed safe internal circuits are not wanting, and must of necessity multiply with the growth of the system.

A flash of atmospheric electricity in a thunder storm effects a consolidation of the high and low pressure circuits within the converter, thus instantly and without warning carrying a doubly death dealing element to the lamp containing fixtures which may at the moment or even subsequently be in contact with the person of the user.

Instances exist of even more remote probabilities of the transfer of dangerous high tension currents, as, for instance, their traversing the iron beams, metal pipes or conducting material not constituting a portion of the electric system. (See Appendix K.)

CAUTION S.

MORAL.

Should the mind of our investor not be influenced by the fact of *original ownership* of the patents which protect the industry of incandescent electric lighting, nor by the *futility of the guarantees* which accompany the wares of the infringers thereof, nor by our presentation of the *relative commercial merits* of the Edison and other systems, nor yet by the liability to *damages for loss of life and property* to which he subjects himself and the members of his community by the introduction of the cheap methods, we would finally inquire of him whether he considers it safe to enter into *business dealings and relations* with men who give public expression to statements which they ought to know to be untrue. That the so-called competitors of the Edison Company have made such statements and do pursue such methods is abundantly evidenced by their own utterances.

The first infringer of Mr. Edison's invention, upon returning from a visit to Mr. Edison at Menlo Park, in 1880, is said to have announced his intention of pirating Mr. Edison's brains and property in these words: "I have been down to see Edison and the — fool has showed me his hand and I mean to profit by it." The result of his visit was the incandescent work of the U. S. Electric Lighting Company. The next infringer spent his sober moments endeavoring to convince the public that Mr. Edison had not, could not, and would not maintain his lamp alight an hour. From thence the Sawyer-Man, now The Consolidated Electric Light Company (see Appendix Q). The next infringer modestly made no pretense at prior invention or other rights, but, lacking the moral courage to stand on his own great achievements and merits, went abroad and purchased the infringing product of a foreign pirate, from which we have the Brush-Swan Electric Light Co. The impetus cupidity thus obtained has grown until the very atmosphere is full of its product. The next aspi-

rants for ownership and profits in this direction were Messrs. Thomson and Houston, and last, but not least, of the great efforts to deprive Edison of the credit and profit of his grand achievement in this branch of applied electrical science comes George Westinghouse, Jr., who announces his plan in these words which are quoted from a pamphlet issued by Westinghouse, Church, Kerr & Company, representing the Westinghouse Electric Company, under the title of

"OUR BUSINESS POLICY"

"is to sell at a fair profit, and install electric lighting apparatus. To accomplish this to the satisfaction of ourselves and our customers, we require only price, guarantee and result. These conditions satisfied, the transaction is complete.

"We regard it as fortunate to ourselves and our customers that we have deferred entering the electrical field until the present moment. *Having thus profited by the public experience of others, we enter ourselves for competition, hampered by a minimum of expense for experimental outlay, and backed by manufacturing facilities and experience second to none. In short, our organization is such that we are free in a large measure from the heavy load with which electrical enterprises seem so far to be encumbered. The fruit of this and other economical measures we propose to share with the customer.*"

In further illustration of the character of the so-called competitors of the Edison Co., attention is called to the nature of their published statements upon the subject of the patent suits as hereinbefore set forth under the heading of patent suits.

In conclusion and by way of emphasizing the confidence of the Edison Company in its position,

FIRST. In respect of its rightful ownership of fundamental patents, and

SECOND. In its belief in the permanent and commercial value of the industry it has created, we beg to call our investors' attention to the fact that the business policy of the Edison Company is to dispose of the exclusive rights to operate its system within the precinct of a given territory in consideration of a percentage of the capital stock of the corporations organized for that purpose. The Edison Co., thus

participates only (having no interest whatever in the manufacturing establishments) in the net earnings of the industry when they shall materialize. Therefore, if the industry itself is non-productive of dividends, the patents have been acquired *without consideration* to the Edison Company.

Note: The consideration carries with it the right to purchase of the Edison manufacturing establishments all electrical apparatus at the actual factory cost, *plus* only a minimum factory profit, fixed by the Edison Company. The corporations thus organized purchase a plant at the lowest cost at which the Edison Company is itself able to contract for its manufacture, and in not one dollar of the price thus paid for the installation of a plant does the Edison Company participate directly or indirectly. Its sole revenue for the use of its patents accrues from what the plant installed shall earn in net returns upon the money invested in it.

All other companies dealing in incandescent lighting, knowing full well that their position is one of to-day only and subject to complete cancellation to-morrow by action of the courts upon the Edison patents, have adopted the policy of selling their plants at a profit upon the goods sold, thereby relinquishing all ownership thereof, "making hay while the sun shines," and incurring no responsibility for or staking no profits on the future prosperity of their customers.

The Edison Company, therefore, pay common interest *with the investor*, whilst all other companies simply sell their goods to enter into competition with the Edison Company, and leave the purchaser to work out his own salvation and answer for himself when the day of judgment shall come.

Attention is further called to the fact that the Edison Electric Light Company is not engaged in the business of creating a large stock interest to be sold to the confiding public at a profit (see Appendix R).

The capital of the Edison Company is \$1,500,000, of which \$1,206,291 represents actual cash paid in, the balance standing against patents acquired from Mr. Edison, but it has, nevertheless, done four-fifths of all the business of incandescent electric lighting.

Whereas, on the other hand, we have a fair sample of the methods pursued by other companies in the capitalization of the Westinghouse Electric Company at \$5,000,000, of which \$100,000 are *said* to represent cash, \$1,000,000 are declared to be "*for sale for cash*," and the remaining \$3,900,000 are admitted to have been issued to Mr. Westinghouse for patents and contracts assigned!!

Persistent and extraordinary efforts to give such capital a market value will perhaps supply a profit not obtainable in the legitimate channels of selling and installing electrical apparatus.

EDISON ELECTRIC LIGHT CO.,

By EDWARD H. JOHNSON,

President.

APPENDIX A.

EDISON'S FUNDAMENTAL SYSTEM PATENT.

From among the many notices of the technical press regarding the recent fundamental "Multiple Arc" patent, granted to Mr. Edison, we select the following:

[*Editorial from the Electrical World, September 10, 1887.*]

Now and then the Patent Office grants patents of very broad sweep, but we are ready to give priority for all-embracing comprehensiveness to that which it has just issued to Mr. Edison, and of which we present all the essential details this week, together with reproductions of the drawings that accompanied the original application. This patent has a great many features of interest. The application dates back to 1880, and locates Mr. Edison at Menlo Park, still engaged on the early work of developing his system. The language of the patent is quaint and archaic, and is, in itself, a revelation of the progress that was to be made. The method of exciting the successive fields, as shown, is almost amusing in its primitive ingenuity. But all these matters sink into insignificance beside the extraordinary scope given to Mr. Edison's claims on distribution. This patent, should it be sustained as it stands, secures to Mr. Edison a monopoly of the whole art and system of multiple arc distribution, and, if we read aright, supplements that by the control of incandescent station operation. That is not enough, for on a modest interpretation "translating devices" *must even include transformers when arranged in multiple arc*. We know of no patent to compare, even at a distance, with this in the electrical field to-day, except that on the Bell telephone, and that which Mr. Brush secured on the storage battery. The fact that the patent is only now granted to Mr. Edison after seven years of delay forces us to believe that the Patent Office authorities must have gone over the ground very carefully and slowly, and yet that they could have been so critical may seem, in view of their final action, rather doubtful. Anyhow, there is the patent for what it is worth, and we should not be surprised to see the Edison Company make the most of it, unless it thinks that it has sufficient litigation on its hands now. That the company attaches some value to the patent may be inferred from the extension it is said to have obtained a little while ago on a number of European patents covering substantially the

same claims, the shortest limitation being that for England, which would bring about an expiration here in 1895.

[*Editorial from the Electrical Review, September 10, 1887.*]

An Important Electric Light Patent.

A good deal of interest is manifested as to patent No. 369,280, issued August 30, 1887, to Mr. Edison, which is in the nature of a surprise to the electric light fraternity. It is illustrated and described on page 9. If the patent is what it seems to be on its face, it would appear as if the entire field of multiple distribution from central stations were now in the hands of the owners of this patent. It has been a long time getting through the entanglements of the Patent Office, having been filed February 5, 1880. The patent is about as broad as a patent can be, being regardless of specific devices and laying a powerful grasp on the fundamental idea of multiple distribution from a number of generators through a metallic circuit.

There will doubtless be a bitter contest in the courts one of these days, with this patent as the bone of contention. We know nothing of the possible merits of such a contest, from any point of view, and it is not our business to go into such a matter, but it does look seriously like war. It certainly is food for reflection by those interested in general distribution of electrical energy from central stations, and this class is growing larger almost daily.

APPENDIX B.

CLAIMS OF EDISON'S FILAMENT PATENT.

Mr. Edison's fundamental lamp patent No. 223,898 was applied for November 4, 1879, and issued January 27, 1880. The claims are as follows:

1. An electric lamp for giving light by incandescence, consisting of a filament of carbon of high resistance, made as described, and secured to metallic wires, as set forth.
2. The combination of carbon filaments, with a receiver made entirely of glass and conductors passing through the glass, and from which receiver the air is exhausted, for the purpose set forth.
3. A carbon filament or strip coiled and connected to electric conductors, so that only a portion of the surface of such carbon conductors shall be exposed for radiating light, as set forth.

4. The method herein described of securing the platina contact wires to the carbon filament and carbonizing of the whole in a closed chamber substantially as set forth.

APPENDIX C.

ENGLISH AND GERMAN DECISIONS SUPPORTING EDISON'S FILAMENT LAMP PATENT.

The suit of the English Edison-Swan United Electric Light Company was brought against Woodhouse & Rawson for infringement of the English patent corresponding with United States Patent No. 223,898 (the claims of which we give in Appendix B).

In the trial before the English Court, the defense produced all the prior patents and publications which can be used in this country to defeat the patent, but it was held to be valid in spite of all these. The nearest previous approach to the Edison construction, and what was principally relied upon by defendants, was a lamp made in England by Swan; which, however, cannot be legally used against the patent in this country, because no description of it was published before Mr. Edison's invention. Even this was held by the Court not to anticipate the Edison claim for a carbon "filament."

This claim has now been upheld in the courts of Germany as well as England, and the result there foreshadows a like favorable termination here.

In this connection the following data on the percentage of patent suits resulting in the confirmation of the patent will prove of exceeding interest. It will answer most decisively the oft-repeated assertion of infringing concerns that the chance of Edison's patents being sustained is very slight.

Patents in the Courts.

BY GEO. H. STOCKBRIDGE.

The statement that nine patents out of every ten are vacated

when they come to be tested before the courts, has been repeated so often among those interested as to have become an adage; but it happens, fortunately, that in the twenty-fifth volume of Myer's "Federal Decisions," published last year, we have at hand a table of patents adjudicated from 1776 to 1885, from which it is easy to compile lists of sustained and vacated patents with a considerable degree of accuracy.

Out of a total of 983 patents passed upon between 1776 and 1885, 269 were declared void, and 714 were sustained. Of the latter number 480 were sustained broadly, and 234 were limited, in view of the state of the art, or by the application of a strict interpretation to the claims. Assuming the above figures to be substantially correct, the number of patents held valid is about 73 per cent. of the whole number on which suit is brought. The above calculation leaves out of account those patents in which only a certain few of the claims were sustained or vacated. There were 157 of the former in the table, and perhaps as many of the latter.

Nine patents sustained to one vacated would not be far out of the way.

While engaged upon the table, I have examined it with respect to the question, now much mooted, whether the attitude of the courts towards letters patent is growing more adverse. I find that, prior to 1860, 197 patents were sustained out of a total of 257 contested, a percentage of about 77. Between 1860 and 1870 the proportion remained substantially the same, falling off a trifle more than one per cent. in the number upheld. Since 1869, however, there has been a marked increase in the relative number of patents which the courts have declared void. The number of patents vacated between that date and 1885 is 116, or more than 35 per cent. of the whole number tabulated. There is no apparent increase during the last part of the period as compared with the first, so that a just estimate of the present condition of things would be that about 35 patents out of 100 are now declared invalid by the courts. It should be stated that the proportion of patents sustained in the preceding analysis is reduced by the inclusion of reissue patents, which, since 1882, have been uniformly vacated.

There need be no hesitation in saying that more than six patents out of every ten are good property, and that the Federal courts will uphold their owners in the defense of them.

APPENDIX D.

CLAIMS OF EDISON'S MULTIPLE ARC SYSTEM
PATENT.

Mr. Edison's fundamental multiple arc patent, No. 369,280, was applied for February, 1880, and issued August 30, 1887.

Its claims, as allowed by the Patent Office, are as follows:

1. In a system of electrical distribution, the combination, with a complete or round metallic circuit, of a number of generators connected in multiple arc with such circuit, and consisting each of an armature revolving in a magnetic field, and a number of translating devices, also connected in multiple arc with said circuit, substantially as set forth.

2. In a system of electrical distribution, the combination, with a complete or round metallic circuit, of a number of generators connected in multiple arc with such circuit, and consisting each of an armature of low resistance revolving in a magnetic field of great strength, and a number of translating devices, also connected in multiple arc with said circuit, substantially as set forth.

3. In a system of electrical distribution, the combination, with a complete or round metallic circuit, of a number of generators connected in multiple arc with such circuit, and consisting each of an armature revolving in a magnetic field and having the coils of its field-of-force magnet and its generating coils separate, (*i.e.*, not connected in series), and a number of translating devices, also connected in multiple arc with said circuit, substantially as set forth.

4. In a system of electrical distribution, the combination, with a complete or round metallic circuit, of a number of generators connected in multiple arc with such circuit, and consisting each of an armature revolving in a magnetic field, a number of translating devices, also connected in multiple arc with said circuit, and a regulator for regulating the supply of current to such circuit, substantially as set forth.

5. In a system of electrical distribution, the combination, with a complete or round metallic circuit, of means for generating electricity connected in multiple arc with such circuit, and consisting of one or more dynamo or magneto-electric machines, translating devices connected in multiple arc with said circuit, an indicator of the electric pressure upon such

circuit, and a regulator under control of the operator for regulating the supply of current to such circuit, substantially as set forth.

6. In a system of electrical distribution, the combination, with a complete or round metallic circuit, of a number of generators connected in multiple arc with such circuit, and consisting each of an armature revolving in a magnetic field, translating devices connected in multiple arc with said circuit, an indicator of the electric pressure upon such circuit, and a regulator under control of the operator for regulating the supply of current to such circuit, substantially as set forth.

7. In a system for the generation and distribution of electricity for light or power, through cities or towns or districts thereof, a central station whereat are combined a number of generators of electricity connected in multiple arc, and consisting each of an armature revolving in a magnetic field, an indicator of the electric pressure, and a regulator of the current generated, conductors forming complete or round metallic circuits leading from such station, to distribute the current throughout the system, and translating devices connected in multiple arc with such conductors, substantially as set forth.

8. In a system for the generation and distribution of electricity for light or power through cities or towns or districts thereof, a central station whereat are combined a number of generators of electricity connected in multiple arc, and consisting each of an armature revolving in a magnetic field, an indicator of the electric pressure, and a regulator of the current generated, conductors forming complete or round metallic circuits leading from such station to distribute the current throughout the system, translating devices connected in multiple arc with such conductors, and meters at the houses for measuring the current supplied to such translating devices, substantially as set forth.

APPENDIX E.

HIGHEST HONORS TO THE EDISON LIGHT.—PARIS,
1881.

The prizes have been awarded by the Electrical Exposition at Paris, and Edison has received two gold medals and a diploma of honor, the highest honor conferred upon any exhibitor. Edison has received from Paris the following cable: "Official list, published to-day, shows you in

the highest class of inventors. No other exhibitor of electric light in that class. Swan, Fox, and Maxim receive medals in class below. The sub-juries had voted you five gold medals, but General Congress promoted you to the diploma of honor. This is complete success, the Congress having nothing higher to give." Professor Barker, of the University of Pennsylvania, present at the Exposition in Paris, also telegraphed Edison as follows: "Accept my congratulations. You have distanced all competitors and obtained a diploma of honor, the highest award given in the Exposition. No person in any class in which you were an exhibitor received a like award." Swan sent Edison a cable complimenting him as follows: "You have received the highest award the jury had to give. I congratulate you."

[*"Independent," Nov. 5, 1881.*]

There are a few salient points in the chronicles of the Paris Exposition of 1881 which the historian of the electric lighting industry will some day write in letters which "he who runs may read."

Among these shining sentences will be seen the frank and manly statement of the Count du Moncel, who, when convinced of the reality of Mr. Edison's long strides of real progress, led the scientific world in paying tribute to his success. We quote from "*Journal des Debats*," Paris, of September 8, 1881:

"Our readers will recollect the furor raised among scientific men of France by the news of the discovery of his system of illumination. It first caused enthusiasm, soon modified by the criticism of competent scientists, one particularly, M. du Moncel, the eminent electrician, manifesting an opposition to Edison's system in an article that caused a great sensation among the most celebrated electricians, and denied its practicability. To be sure, an ocean lay between the laboratory of the hermit of Menlo Park and the study of M. du Moncel; but since Edison's system has crossed the sea, M. du Moncel has changed his opinion, for, in a letter which has been shown us, he welcomes the new arrival, after enumerating the experiments with other incandescent lamps, in these words:

"All these experiments achieved but moderate success, to say no more, and when, in 1879, the new Edison incandescent carbon lamp was announced, many of the scientists, and I, particularly, doubted the accuracy of the reports which came from America. This horse-shoe of carbonized paper seemed incapable to resist mechanical shocks, and to maintain incandescence for any con-

"siderable length of time. Nevertheless, Mr. Edison was not discouraged, and despite the active opposition made to his lamp, despite the polemic acerbity of which he was the object, he did not cease to perfect it in a practical view, and he succeeded in producing the lamps, which we now behold exhibited at the Exposition and are admired by all for their perfect steadiness."

"Here are declarations which certainly cannot be suspected, and which do honor, at the same time, to their author and to him who is the subject of them."

APPENDIX F.

LITIGATION AMONG THE GIANTS.

Edison vs. Westinghouse.

[*Editorial from Modern Light and Heat.*]

APRIL, 1887.

We have lately received many inquiries regarding the suits of the Edison Electric Light Company against the Westinghouse Company, now pending, evidencing a rapidly growing interest in the matter on the part of the electrical fraternity. Very little seems to have been known as to the specific infringements charged by the Edison Company.

The suits are based mainly on infringements of the "conversion" or "transformation" systems, which have been so energetically pushed to the front by various electric companies, notably the Westinghouse, and are eleven in number, the first having been brought at Trenton, N. J., on account of the imitations claimed to have been made of the three-wire system. The central station work of this type was limited to Trenton, N. J., and Schenectady, N. Y., and the arguments brought forward charged a settled purpose on the part of the Westinghouse Company, not only to appropriate whatever seemed suited to their uses, but to acquire all possible information by attracting from the ranks of the Edison Company's force such men as were possessed of a knowledge of the methods by which satisfactory results had been obtained.

The following letter just issued by Mr. John C. Tomlinson, counsellor of the Edison Electric Light Company, is sufficiently explicit concerning the nature of the patents involved in this and other suits as to afford a better understanding of the entire situation. The numerous interests liable to be affected by this litigation are of such vital importance that we publish in full, for the benefit of our readers, Mr. Tomlinson's letter, which is as follows :

JOHN C. TOMLINSON,
Counsellor at Law.

40 Wall Street,
NEW YORK,.....1887.

GENTLEMEN: I am advised by the Edison Electric Light Company that you contemplate building and operating a Central Station Incandescent Electric Light Plant, and I am instructed by that Company to inform you that by so doing you will infringe among others the following Letters Patent of the United States owned by them, to wit :

1. Thomas A. Edison, No. 266,793, dated October 31, 1882, on Electric Distribution System.
2. Thomas A. Edison, No. 280,727, dated July 3, 1883, on Systems of Electrical Distribution.
3. Thomas A. Edison, No. 287,515, dated October 30, 1883, on System of Electrical Distribution.
4. Thomas A. Edison, No. 274,290, dated March 20, 1883, on Systems of Electrical Distribution.
5. Thomas A. Edison, No. 287,517, dated October 30, 1883, on System of Electrical Distribution.
6. Thomas A. Edison, No. 265,784, dated October 10, 1882, on Regulators for Dynamo-Electric Machines.
7. Thomas A. Edison, No. 283,986, dated August 28, 1883, on Systems of Electrical Distribution.
8. Thomas A. Edison, No. 264,642, dated September 19, 1882, on Electric Distribution and Translation System.
9. Schuyler S. Wheeler, No. 335,099, dated January 26, 1886, on System of Electrical Distribution.

10. Frank J. Sprague, No. 335,045, dated January 26, 1883, on Systems of Electrical Distribution.

11. William S. Andrews, No. 317,700, dated May 12, 1885, on Systems of Electrical Distribution.

Suits have been instituted by the Edison Company upon these patents against Westinghouse, Church, Kerr & Co., who are acting as the exploiters of what is called the Westinghouse system (which so-called system I am informed is the one you contemplate using), in the United States Circuit Court for the District of New Jersey. Should the decisions in these suits be favorable to the Edison Company, they will at once proceed to obtain injunctions throughout the country against all infringers of their patents, and will at the same time bring action to recover damages for past infringements.

In addition to the suits referred to above, the Edison Company had previously instituted, and are now pressing suits in the Circuit Court of the United States for the Southern District of New York, against the United States Electric Light Company and others, upon the following patents: Nos. 265,311, 251,554, 223,898, 227,229, 265,777, 239,149, 239,153, 248,419, 264,698, 230,255, 266,447, 248,424, 288,318, 263,140, 307,029.

These patents are also infringed by Westinghouse, Church, Kerr & Co., and will also be infringed by you in case you erect and operate the station referred to.

Upon the determination of these suits, proceedings for injunctions and damages will likewise be instituted against all infringers throughout the country, including Westinghouse.

It is entirely impractical at the present time for the Edison Company to multiply litigations upon the same patents in different sections of the country, and they have adopted the course usually followed in such cases, of proceeding against the responsible promoters of the infringements and awaiting the determinations of these litigations before instituting proceedings against the users.

The object of this communication is to furnish you with exact information of the patents which it is claimed you will infringe, and of the suits now pending before the courts against the promoters of these infringements, and of what you may expect in case you determine to disregard the patents referred to. Having furnished you with this information and notice, you can procure copies of the patents referred to, and can determine for yourselves whether the

station you contemplate erecting and the apparatus and methods you desire using will infringe the same, and you can also easily verify the statement I have made in regard to the pendency of these suits by communication with the clerks of the courts to which I have referred.

This communication is dictated by a still further object, and that is, by giving you the information referred to, to deprive you from saying hereafter when suits shall be brought against you, that you acted innocently and without knowledge of the rights of others.

(Signed,)

JOHN C. TOMLINSON,
Counselloer for the Edison Electric Light Company.

In the more recent exploiting of the "Converter" system, many of the same principles of current distribution and regulation are involved, and the Edison Company claim that almost as many of their principal patents are infringed in the latest Westinghouse installations as at Trenton. The Philadelphia suits, which are brought against the Keystone Light and Power Company of that city, a subsidiary of the Westinghouse, are upon Nos. 4, 6, 7, 8, 9 and 10, as in above letter of Mr. Tomlinson, and patent of Thomas A. Edison, No. 283,984, dated August 28th, 1883, on Systems of Electrical Distribution, and patent of Charles Bradley, No. 280,563, dated July 3d, 1883, on Electrical Measuring Apparatus.

APPENDIX G.

ROYALTIES COLLECTED IN ENGLAND AND ELSEWHERE.

Mr. Justice Butt's decision of May, 1886, in favor of the English Edison Company, not only decided Edison's priority of invention, but ordered all other lamps destroyed or given into the possession of the Edison Company, and an accounting of the profits made by the sale of the infringing lamps and other electrical appliances already sold. This virtually threw all other incandescent lamps out of the United Kingdom except upon payment of royalty to the Edison Company.

The secretary of this organization at once issued circular letters to private parties using the Woodhouse & Rawson and other lamps, of which the following copy is taken from the "Electrical Review" of July 9, 1886:

"EDISON AND SWAN UNITED ELEC. LT. CO., LIMITED,
"13 Albert Mansions, Victoria St.,
"Westminster, S. W.

June 29th, 1886.

"DEAR SIR—We find that you are using incandescent electric lamps which are made in infringement of this company's patents which have been recently upheld by the decree of the High Court of Justice under proceedings instituted by the company against other infringers.

"I have to request that you will at once discontinue the use of those lamps, and upon your notifying me of your willingness to do this, I will make arrangements for sending for the lamps at such early date as may be convenient to you.

"If I hear from you not later than Monday next, 5th July, with the undertaking above referred to, the company will abstain from taking proceedings against you, either for an injunction or for damages—a course which the directors have authorized me to take, in the belief that you were not aware that by the use of the lamps in question you were infringing the companies' rights.

"I am, dear sir, yours faithfully,

"(Signed)

S. FLOOD PAGE,

"Secretary."

On receipt of one of these, accidentally sent to one of their agents, the following humorous reply was returned: "We think this a most unwarrantable and vexatious proceeding on your part, calculated to leave a very prejudicial effect on our interests and yours. We are using your lamps exclusively, and think that you owe us an apology for this procedure." (Signed, Muir Mavor, C. M.)

The "Review," in a lengthy editorial, concedes the legality of this course, but doubts its policy. One extract will illustrate the great strength of the position thus fortified by the potency of patents when sustained by the courts:

"We think the Edison Company would act much more sensibly if it allowed installations actually in operation previous to the recent legal suit to remain *in statu quo*, enforcing its rights against infringing manufacturers and all future users of infringing articles as fully as it thinks fit. Now is the time when the company has it in its power either to make friends or enemies."

In the *Review* of July 30, 1886, appears a report of the directors of the Edison-Swan United E. L. Co., Limited. It is there stated that, "The amount due from Messrs. Woodhouse & Rawson under the judgment could not yet be estimated, and had not been brought into the accounts. The order was now in form and they would endeavor to take the account, which, he understood, meant going through the books of Messrs. Woodhouse & Rawson, and tracing what they had done with the infringing lamps. He had reason to believe that they had sold an enormous number, and, therefore, there was a considerable sum of money to come from those gentlemen."

APPENDIX H.

RECKLESS GUARANTEES NEVER MADE GOOD.

In the *Louisville Courier-Journal* of October 29, 1883, appeared the following statement made for the United States Electric Light Company:

"I have demonstrated that we can run a great many more lamps with the same power than the Edison people can. Of this the Palmer House people are entirely convinced."

(Signed) C. C. WARREN.

"The United States Company wish it stated with emphasis that it guarantees thirteen lamps of sixteen candle power per horse power, being double the number guaranteed by any competitor, and its machines are automatic."

(Signed) J. E. Lockwood.

This is but one illustration of the wild guarantees which have been put forward by companies having in some cases not so much as a lamp which would live 100 hours. The character of these

professions was clearly exposed by the Franklin Institute tests at Philadelphia in 1885. In a trial of 1000 hours the record of breakage was as follows:

Edison, 1 out of 21.

Woodhouse & Rawson, all of 11.

Stanley, 19 out of 22.

The U. S. Co. (Weston), 17 out of 24.

Edison thus lost 5%; and Weston 65%. The value of an Edison lamp was thus shown to be twelve or thirteen times that of any other. These tests have been confirmed by those made at Berlin, Vienna, London, Paris, Louisville, Cincinnati and elsewhere.

APPENDIX I.

PROSPECTIVE IMPORTANCE OF MOTORS IN CENTRAL STATION WORK.

It is sufficient, in illustrating the great importance of the business of the future in the transmission of small powers, to cite the growing use of motors in the Boston and New York stations. At present, after only a year of effort, Boston has 100 motors, aggregating a capacity of 300 horse power, in daily operation, and the demand constantly increasing. The New York company has attached within a few months over 150 horse power. The franchises of Edison central stations include not only this profitable application of the power they distribute; but that of heating by electricity, which is now clearly made apparent is the next immediate practical application of electricity on a vast scale.

APPENDIX J.

DANGERS FROM HIGH POTENTIALS

Might be illustrated at great length. The few which are of more recent date are given without comment:

[*Detroit Press*, Oct. 4th, 1887.]

Deadly Electric Light Wires.—The Shocking Sight which Met the Gaze of Passers-By on a Detroit Street.

DETROIT, Mich., Oct. 4.—A corpse sixty feet from the earth hanging in a nest of wires, the arms and legs moving perceptibly, was the ghastly sight which greeted people last night at the corner of Woodward avenue and the Campus Martius. The discoverer of this shocking sight called the fire department. The dead man was got down with an extension ladder. He had been dead for some time and his body had received the electric current of the entire Brush system, which had made his limbs move as if in convulsions. Thus perished Lineman Hiram Corliss. Nobody knows how long he had hung on the wires. The securing of the body was attended with great danger because the electric current was still on. Corliss, in repairing or looking for a break, had made a fatal find.

[*N. Y. Sun*, Oct. 24th, 1887.]

You Can't Hush it Up.—When an Electric Light Kills a Man there's no Keeping Mum About It.

George Schneider, the young man who was killed on Saturday in the Harlem Electric Light Company's building, 244 East One Hundred and Twenty-second street, was an inspector of lamps for the company. He received his death stroke from a defectively insulated lamp which hung in the cellar of the building. It was an arc light of the familiar street light pattern. It hung in front of a big dynamo machine in the cellar. Two men were working about the dynamo, and Schneider came down to look at them. As he leaned forward his hat struck the lamp and set it swinging. Without a thought of danger he caught hold of the round, brass-finished tube which holds the bottom carbon. With a spasmodic shiver he fell to the ground. The men raised him up and one of them ran across the street for Dr. T. H. Hay. It was not more than five minutes after the shock that Dr. Hay arrived. He found Schneider just gasping his last breath.

At the office of the Harlem Electric Light Company no one would give any information yesterday about the accident. Lamps of this kind are extremely dangerous. The current used is one of great intensity. If the lamp is in order the wires and carbons are all insulated from the frame. In this case there was a contact some-

where, and when Schneider caught the lamp the whole strength of the current passed through his body to the ground.

Schneider was unmarried and lived with an uncle at One Hundred and Seventeenth street and First avenue.

[*N. Y. Sun*, Dec. 6th, 1887.]

Fatal Shock From an Electric Wire.

LYONS, N. Y., Dec. 5.—Elmer E. Wood, Manager of the Canandaigua Electric Light Company, was killed by an electric shock in that village last evening. He started to go home, but noticing that an electric lamp on the street did not burn clearly, he attempted to fix the carbon in it. His kid glove was wet, and coming in contact with the wire, he received a terrible shock. He was heard to groan, and then dropped unconscious on the ground. He was picked up a moment later and breathed his last. The only mark on him was a small and black hole in his thumb.

[*Chicago Tribune*, Dec. 12, 1887.]

Killed by a Flash—A Theatrical Manager Struck Dead by an Electric Current.

CINCINNATI, O., Dec. 11.—[Special.]—James O'Connell, stage manager of the Michael Strogoff company of Harris' Museum, was instantly killed by receiving an electric shock from the speaking-tube on the stage while the matinee on Saturday afternoon was in progress. It seems that the insulated covering, where the wire was attached to the electric light, covered the speaking-tube leading across the stage to the prompter's box, had worn away and the current thus diverted ran along the metal tube, and charged with the same intensity that is usually applied to the lamps. But it could be touched in perfect safety by any one who did not insert himself in the circuit. O'Connell unfortunately did the latter, the other side of the connection being made by laying his right hand on the zinc-covered box from which the gas-burners are controlled. The instant he seized the brass ring of the bell wire the current was changed from the circuit and passed through his body to the ground. Standing at his side were the stage carpenter and the costumer. The latter declares that when O'Connell took his hand from the pipe in the act of falling a spark fully five inches in length followed it seeming to connect with

the tips of his fingers. A stage hand hearing O'Connell's cry rang down the curtain. Springing over O'Connell's body he accidentally laid his hand on the zinc-covered box and received a powerful shock. In the palm of O'Connell's right hand was a whitish streak from the wrist to the finger. Closer examination showed it to be a blister, which seemed to pierce almost through the hand. On the left hand the thumb and index finger were dreadfully torn. The skin was burned to snowy whiteness, as was the flesh beneath. The dead man was about 28 years of age and has been a stage manager and carpenter for eight years, being with Shook & Collier of Union Square, New York, for six years. Two years ago he took a place with the present organization, the Charles Edwards Michael Strogoff company. One of the most pathetic features of the sad affair was that it occurred almost in sight of the dead man's affianced wife, Nellie Collins, a member of the company. Her grief as she tried to detect some sign of life in his still face was extremely touching. O'Connell's home is in Chicago, where his remains will be shipped to-morrow. From the conversation of those in the theatre he was regarded as a general favorite among his fellow-employees. The audience was entirely unaware of the fatality. The accident is thought attributable in a great degree to the humidity of the air, this affecting the insulation of the wire, causing the current to turn to the tin tube. Had it been a dry day it is not believed that it would have occurred.

[*Brooklyn Eagle*, Dec. 11, 1887.]

He Fooled with Lightning.

About 8 o'clock last evening Ambrose Hilbert, of 35 Moore street, aged 14 years, while crossing Broadway, at Debevoise street, caught hold of the end of a broken telegraph wire, which was held suspended by an electric light wire, across which it had fallen. Instantly he gave a scream and fell stunned on the street. A number of citizens immediately ran to his assistance, and it was found that his left hand had been badly burned by the electric current and that in falling he had sustained a severe scalp wound. He was removed to his home.

[*N. Y. Sun*, Dec. 20, '87.]

Killed by Electricity.

MARION, Ind., Dec. 19.—A team of horses owned by D. P. Mc-

Kinney was killed here this evening under peculiar circumstances. One of the natural gas arches was torn down by a passing load of straw, and the electric light wire which was attached dropped to the street. McKinney's team following a few minutes later, stepped on the charged wire and both horses fell dead from the shock.

APPENDIX K.

SOME DANGERS OF THE ALTERNATING SYSTEM.

Dr. Otto Moses, the apostle of the alternating system, made the following statement in August last, before the National Electric Light Association, at its session in Boston:

"A friend of mine was testing a 400 light 1050 volt alternating dynamo fully loaded only a few days ago, and going towards the machine, his foot slipped and he fell quite close to it; in his confusion he quickly reached out his hands and unfortunately placed them directly upon the poles of the dynamo. He said from where he fell to the walls behind him was about fifteen feet, and it seemed to him as if that dynamo was suddenly converted into an electrical gun, and he got shot across the room until the velocity of his movement was interfered with by the wall."

At the same meeting, W. R. Kimball of Boston, electrical expert, said:

"The question of the insulation of high potential wires is one which appeals to every part of the electric light station, whether he be line-man or manager. In the one case, it is his own life and limb that are involved; and in the other case it is property. And yet there is danger in carrying high potential wires into cellars and basements."

"The question of the insulation between the primary and the secondary of the inductive coil is governed by a variety of causes. Where converters are placed out of doors moisture will get in. No matter how careful the wires may be placed, the current will be affected. This bold expedient of grounding the inside wire has been brought to the attention of this Convention and the public by some of the electrical papers. It seems to me that it opens a field for discussion. The question naturally arises in the minds of insurance men whether running electrical wires down to the ground is not an unheard of thing."

One of the prominent exponents of the Westinghouse methods also said at the same session :

"In Pittsburgh, where we were running lights in a rather poor neighborhood, we found it cheaper to run secondary mains, attaching our lights in the houses from the secondary current, using fifty or one hundred volts as we pleased. In other parts of the town, where they were using fifteen or twenty lights in each house, we found it better to carry the converters into the building or fasten them as close as possible on the outside wall, so as to enable us to use the fifty-volt lamps exclusively. In the case of hotels, we would run a high-pressure wire down the centre of the corridor, and place converters at each group."

In marked contrast with this confidence inspired by ignorance and recklessness, we find that a year ago the eminent European electrical firm of Siemens & Halske, in a pamphlet issued by them on alternating currents, gave an alarm of no uncertain sound. The fact should be borne in mind that they were really the inventors and the builders of the best alternating machinery which has ever been offered to the public, that the product of their mammoth factory has been widely used for a long series of years, and they have discontinued building this apparatus as being dangerous. They conclude in these words:

"SO FAR LEGISLATION HAS NOT CONCERNED ITSELF WITH THE DANGERS OF THIS SYSTEM, BUT SOONER OR LATER WILL BE COMPELLED TO DO SO."

Recent advices show that action has since been taken to prohibit the use of high-tension alternating currents.

It is also noteworthy that in the United States the insurance companies have been independently led, because of actual burning out of converters, and explosion of their metal cases, to absolutely prohibit their placement in buildings.

This restriction has recently been enforced, even in cases where underground services had been introduced and the converters placed on the walls of cellars. No more forcible commentary can be imagined of the distrust felt by the underwriters in subjecting their risks to

the hazards of high-pressure currents, than the rule issued November 1, 1887, by the Boston Board of Fire Underwriters:

"Converters on alternating circuits must be outside of buildings, and must be placed high enough from the roof to prevent possible injury to firemen."

Within a few days of this issue (November 4, 1887) the New England Insurance Exchange, at a meeting of representatives of all the electric light companies doing business in the Eastern States, called to consider this subject, gave notice that they should under no circumstances allow converters to be placed within the walls of buildings.

In Philadelphia, the only city where these silent dynamos are thus tolerated inside the walls of buildings under any intelligent supervision, Inspector McDevitt of the Insurance Patrol confines them strictly to cellars, and states distinctly that they will be obliged to go to the street the moment any one of them explodes or sets a fire.

In Chicago, City Inspector Haskins absolutely prohibits the use of any alternating current system or other high-pressure makeshift for incandescent lighting.

[Extracts from the *Daily States (New Orleans)*, Sept. 23, 1887.]

Electric Wire Dangers. How Linemen are Injured or Killed. The Alternating Current as Contrasted with the Low Tension Direct Current.

Several accidents have happened of late to linemen of electric light companies, who have been knocked senseless by coming in contact with wires while in the performance of their duties. Tuesday last a lineman in the employ of the Edison Light Company was knocked from a pole at the corner of Canal and Carondelet Streets by receiving a shock from a wire charged with the alternating high tension current from the Westinghouse machines used by the Brush Electric Light Company.

The accident was the second serious occurrence in this city from the Westinghouse alternating current. Fortunately it has not so far turned out to be fatal as did the accident of a month ago, which occurred as follows: The unfortunate man who was killed

was at work on a pole pulling up a dead arc wire, when his foot slipped and he fell across the wires carrying the alternating current, which wires had been bared of insulation in order to tie them in firmly to the insulators. The man was suspended by the wires, and the current passed through his body from the inside of one thigh to the upper ribs on the other side, the flesh being burned to the bone in both places. It was probably five minutes before they could switch off the current from him and by that time he was stone dead.

Two serious accidents, one being fatal from the alternating current in the course of five weeks, render it necessary to call attention to this new element of danger in the streets, and to consider what precautions should be taken. The alternating system is new in this country, and very little experience has been had with it compared with the arc system. However, this experience has shown that this current is quite as dangerous, if not more so, than the arc current, which has killed so many men. There are two reasons for this: first—the full pressure of current (1,000 to 1,200 volts) is on every pole-line circuit; second—the wires running parallel with one another only a short distance apart, it is very easy to obtain a shock; in fact it is very difficult for a man working on a pole to avoid receiving a shock sufficient to knock him from a pole, and should he be suspended and unable to free himself, as occurred in the fatal accident referred to, the shock quickly proves fatal.

The effects of an alternating shock merely from leakage are graphically described in the records of the convention before referred to. Mr. Smith of the Westinghouse Company detailed the prostration of a veteran lineman who was unable to release himself, became black in the face, was treated for asphyxia, and was so severely burned that his hand was opened by the attending surgeon. Those who went to his assistance were painfully shocked in spite of careful protection to their own persons.

Not alone is this current dangerous to station employees. The "New York World" of December 12, 1887, has the following account of the death of a horse:

Killed by Electricity. A Horse Touches a Telephone Wire on Staten Island and Drops Dead.

"A singular accident resulting in the death of a horse belonging to C. F. Gaellis, a cracker dealer, at Mariners' Harbor, S. I., occurred

this morning at 4:30 o'clock. Mr. Gaellis sends his wagon with a double team to this city early every Monday morning.

While his driver, Christian Klengel, was passing in front or near the residence of Dr. W. C. Walsh at Port Richmond, S. I., one of the horses became entangled in a telephone wire which was dangling in the street, being broken, and in a twinkling the horse, valued at \$250, was dead.

Policeman Finan, who was near by, attempted to remove the horse from the middle of the street to the gutter, when he received a severe electric shock which knocked him senseless. He soon recovered.

Some time during the night one of the telephone wires broke, and, falling across the electric light wire, became charged with electricity, and when the horse was entangled, the circuit to the ground was complete. Hence the accident."

NEW ORLEANS, La., November 29th, 1887.

E. H. JOHNSON, Esq.,

Prest. Edison Electric Light Company, New York.

DEAR SIR: As New Orleans is with one exception the largest and most important station now supplying incandescent lights on the Westinghouse Alternating system, you will doubtless be interested to hear some account of its operation during the eight months of its existence.

Their record during this period has been a continual series of mishaps. They have suffered damages and interruptions from almost every possible cause, viz.: engines, dynamos, line wires and converters.

The alternating current has killed two men and has injured several others. One of these accidents has resulted in a lawsuit for \$25,000 damages, and it is rumored that another suit is contemplated on behalf of the relatives of one of the men killed. This was a telephone lineman and was at the time stringing wires in the ordinary way. The telephone company have applied to the courts for an injunction against the Brush company using a Westinghouse alternating system to prevent them from running their wires in proximity to telephone wires or poles.

Some time ago one of their high tension alternating circuits dropped on to a tin roof and set the woodwork underneath on fire. The fire department were called out and had considerable difficulty in extinguishing the flames. The short circuit burnt out a 1,300 light

armature, whereupon the dynamo man threw another machine into circuit, and a second armature burned out.

About ten days ago they knocked out a cylinder head and broke the cross-head of one of their large Corliss engines, carrying a 1,300 light and a 650 light dynamo. Having no reserve, all the lights supplied by these dynamos were out a week, their customers having to resort to gas, candles or kerosene. After four days they got their engine repaired and started again. Shortly after starting one of the 1,300 light armatures burned out from no apparent cause. Putting in the only spare armature they had they ran all right for about twelve hours, when the second armature burned out in the same way.

This caused another delay of three days, and made a total to date of four armatures burnt out.

On a recent Saturday evening a pulley came off one of the 1,300 light machines, putting a theatre, among the rest, in darkness for half an hour.

Until their dynamos were fairly loaded they ran with a fair amount of satisfaction except during thunderstorms, during which the lightning played havoc with the converters, burning out from three to seven every time.

In addition to the above they have had a large number of mishaps of which I have not heard the details.

Naturally their customers are all very much dissatisfied, and it is a very common thing to see the Westinghouse lights helped out by gas, or arc lights burning at the same time.

They light up the prominent clubs, and unfortunately for them they are all supplied by the circuit which was disabled for a week through the breaking down of the engine and the burning out of the two armatures.

The operation of the Westinghouse system has been disastrous financially to the local Brush company. Previous to commencing with it they were in a sound financial condition. Now they are nearly bankrupt and are at their wits' end to know how to raise money to go on. Their hundred dollar stock is unsalable at twenty-five; in fact a block was recently sold at twenty-two. A gentleman whom I know has a large amount of stock which he could have sold a year ago at \$85, and he would now be glad to get \$30. The daily paper for Jan. 13, 1887, quotes Brush stock at \$73 "asked," to-day's paper gives \$35 "asked" and \$20 offered. On the other hand

the recent breakdown of the Westinghouse system has caused gas stock to go up five points within a week.

Yours very truly,

WM. T. M. MOTTEAM.

PROF. CARHART'S WARNING.

In a communication to "The American Engineer," Prof. H. S. Carhart thus sums up the salient points of an interesting discussion:

"It is not probable that an estimate of the danger point of a current can be made by a calculation of the energy involved. It is absolutely certain that quite a powerful current can be taken through the body, provided it be perfectly steady, while a fluctuating current of much smaller intensity may prove fatal. The one implies the steady passage of energy through the person, while the other applies a series of shocks. A single blow may prove fatal, but a succession of them will be more certain to do so. A single flash of lightning may kill or in some cases char the body to a cinder, and a succession of a thousand or more shocks a second from a mechanical generator of electricity may prove no less dangerous. In short, the danger lies more in the discontinuity of the current than in its absolute intensity. With a given discontinuity, the higher the E. M. F. the greater the danger. Hence, also, alternating current generators are far more dangerous than those of the Gramme type yielding continuous currents. On this account the system distribution by a main alternating current of high pressure, producing secondary currents by means of induction coils, is not to be commended, however efficient it may be."

APPENDIX L.

THE EDISON ELECTRIC ILLUMINATING CO. OF NEW YORK,
16 and 18 Broad Street.

Spencer Trask, President.

Jonn I. Beggs, Vice-President and General Manager.

J. B. Skehan, Secretary and Treasurer.

NEW YORK, December 27th, 1887.

E. H. JOHNSON, Esq.,

President Edison Electric Light Co.:

DEAR SIR—Replying to your inquiry as to the accuracy and de-

gree of reliance placed upon the Edison meter in the commercial transactions between this company and its customers, it affords me pleasure to state that our experience has established confidence in the meter, not only on our part, but also on the part of our customers, in consideration of which I offer you the following facts:

The Pearl Street Station was started September 4th, 1882, and, with the exception of but two hours during the first year, has continued uninterruptedly to date.

The station is at present supplying current for 15,000 incandescent lamps and 150 H. P. of Sprague Electric Motors to 647 customers through a like number of meters.

Our bills are paid cheerfully with but an occasional exception, in which instances a verification of the meter is had, and the customer thereby thoroughly convinced of its accuracy.

Repeated tests of the meter, comparative and otherwise, made by ourselves show a maximum variation of not greater than 2 per cent. and a variation from accuracy of not more than 1 per cent. These tests, combined with the practical results of five years actual use of several hundred meters, have demonstrated conclusively to the company and its customers the efficacy of the apparatus for the purpose intended.

Yours truly,

THE EDISON ELECTRIC ILLUMINATING CO. OF NEW YORK,

By JOHN I. BEGGS,

Vice-President and General Manager.

APPENDIX M.

"THE DEADLY PARALLEL"—ACTUAL FIGURES SHOW WESTINGHOUSE INDIRECT CONDUCTORS COST MORE THAN EDISON DIRECT, IN EACH OF TWO RECENT ESTIMATES.

Denver, Col., recently secured from the Edison Company an estimate to be used as the basis of a contract. The figures below show a summary of cost for which the Edison contractors were prepared to equip and guarantee the operation of the system.

The figures representing the Westinghouse plant now under construction show money stated to have been expended, leaving this portion of the installation still incomplete, with no assurance of being able to

operate successfully, on account of retardation in underground conductors and other undetermined factors.

Denver, Col.

*Edison Direct System Estimate,
10,000 Lights.*

*Westinghouse Indirect System,
6,500 Lights.*

Mains, Feeders (all underground) and Laying Underground—

Total.....\$88,456

Which makes the Contract Price of Underground Conductors (complete) per lamp.....\$8.85

Mains (overhead) and feeders (underground) with pole lines, conduits and other necessary construction with converters, but without secondary mains or services (all of which are of necessity a portion of the conductor system), over \$100,000, or \$15.40 per lamp.

In contrast with this record of necessary expenditure, with no demonstration of satisfactory service as a fully loaded system up to the present, notice the following estimate of the Westinghouse Company for Minneapolis. Even here the "deadly parallel" shows no saving in cost of copper in the indirect alternating method, after making all possible allowance for the difference in the estimated capacity:

Minneapolis, Minn.

Estimate made May, 1887, as planned by the Edison Co. for 21,700 Lights:

Westinghouse Indirect System, for 8,400 Lights:

Copper in Feeders,
254,000 lbs. @ .17..\$43,180
Copper in Mains,
51,680 lbs. @ .17....\$8,785
Feeders.....\$2.00 per light.
Mains......40 " "

Copper in Feeders and Primary Mains,
71,200 lbs. @ .17....\$12,100
Converters @ \$1.50 per light\$12,600
\$24,700

Total Copper..\$2.40 " "

This does not include the secondary mains, which are essential to good distribution, and which on account of the use of a 50 volt lamp are necessarily very heavy. Feeders and Converters and primary mains, \$2.94 per light.

DIAGRAM SHOWING THEORY VS. ACTUAL PRACTICE.

T H E O R Y		P R A C T I C E	
EDISON 3 WIRE AS CLAIMED BY WESTINGHOUSE IN ELECTRICAL ENG. SEPT. 1, 1887.		EDISON 3 WIRE	
\$33,800.		COPPER IN MAIN AND FEEDERS COMPLETE, \$23,800.	
COPPER FOR ENTIRE SYSTEM, 8,400 LAMPS.		COPPER FOR ENTIRE SYSTEM, 8,400 LAMPS.	
WESTINGHOUSE CLAIMS AS PER ELECTRICAL ENG., SEPT. 1, 1887.		COPPER IN MAIN AND FEEDERS FOR SERVICES AND INTERIORS AT 800. PER LAMP, \$4,300.	
\$4,380 COPPER FOR ENTIRE SYSTEM, 8,400 LAMPS.		COPPER IN MAIN AND FEEDERS, \$12,100.	
		WESTINGHOUSE INDIRECT	
		COPPER FOR SERVICES AND INTERIORS AT \$2.50 PER LAMP, \$21,000.	
		MINNEAPOLIS AS LAID OUT BY THE EDISON CO. FOR 3 WIRE SYSTEM ON SAME PLANS AS WESTINGHOUSE ALTERNATING STATION SAME LOCALITY, 8,400 LAMPS; AVERAGE DISTANCE, 4,000 FEET.	
		MINNEAPOLIS AS LAID OUT AND PLANNED BY THE WESTINGHOUSE CO. FOR THEIR ALTERNATING SYSTEM; 8,400 LAMPS; AVERAGE DISTANCE 4,000 FEET.	
		EDISON 3 WIRE DIRECT SYSTEM, 4.40 PER LAMP.	
		WESTINGHOUSE INDIRECT " 6.72 " "	
		COPPER @ 170. LB.	

In the above estimate we have assumed that the prices of converters may have fallen fifty per cent. since the issue of the pamphlet of some months ago (elsewhere described), in which (page 70, Schedule K) fifty light converters are quoted at \$3 per lamp, or even since Mr. Wm. Stanley Jr., now before the public, as the Electrician of the Westinghouse Company, has had an opportunity of correcting his note book in the laboratory. This gentleman in an address before the Society of Arts in Boston, December 22, 1887, conceded that converters should be calculated at \$3 per lamp. This raises the above Minneapolis estimate to \$4 38 per lamp.

These figures, taken from actual working specifications and plans issued from the office of the Westinghouse Company, tell a story radically at variance with the professions of their purchasing agent, and one of their original stockholders and directors (See Appendix R), Mr. Frank L. Pope, through the columns of the journal conducted by him, which has for several months past been used as the organ of the alternating school. (See Electrical Engineer, Sept., 1887, page 342.)

APPENDIX P.

RECOGNIZED DANGERS OF HIGH ELECTRICAL PRESSURES.

The experience of the most successful managers of arc plants in this country has been to discourage the use of dynamos giving more than 35 to 40 lamps in series, on account of the high pressure required by very long circuits. An instance in point is the recent order of the manager of the Brush Company of New York, for 25 dynamos of 30 lamps capacity ("Electrical World," Dec. 24, 1887). The position taken by Mr. Chas. Lever in the article in the English "Electrical Review" of Oct. 31, 1885, to which we have elsewhere referred, is startling in the correctness of its forecast:

"But, it is this eternal desire to get as many lamps in series from one machine as possible, which no doubt prevents such a course from being adopted in regard to increment of current. Whatever may be the advantages of this high tension supply system, they are completely annulled by the element of danger introduced thereby. De-

spite all that may be argued to the contrary, men will continue to be killed in the future as in the past by such systems. During the past two or three years the electro-motive force of certain dynamos has risen in America from 2,000 volts to 3,000 volts. In other words, 40 lighters have given way to 60 lighters. The danger already exists, and would not be greater even if 100 lighters are built in the future."

To give an idea of the keen sense of danger felt by the Underwriters, after nearly ten years' experience with high pressure currents, we quote as follows:

Rules of New England Insurance Exchange.

No attempt must be made to join a separated or broken wire while the current is on.

The running of concealed wires to electroliers or lamps, *under any circumstances*, is strictly prohibited. They must be entirely open to view.

Conducting wires should not approach each other nearer than one foot. They must be at least seven feet above the highest point of flat roofs.

Rules of the Boston Manufacturers' Mutual Fire Insurance Company.

Wires should not approach each other nearer than one foot, and twice that distance is preferable in conducting electricity of high tension.

Rules of the Phoenix Fire Office, London, of 1887:

"Where secondary generators (converters) are employed, and the alternating primary current is of high electro-motive force, it is preferable that neither the secondary generators nor any portion of the primary circuit in connection with them be placed inside any building, but in a fire-proof structure apart."

"The switches and cutouts must be enclosed in fire-proof boxes outside of the building."

"The whole of the primary work (including conductors, secondary generators, switches and cutouts) should be so placed and protected that it could not be tampered or interfered with by unauthorized persons."

APPENDIX Q.

SAWYER'S EARLY IGNORANCE AND SUBSEQUENT ENLIGHTENMENT.

The following extracts from statements of W. E. Sawyer, pub-

lished within the first three months of 1880, forcibly illustrate the ignorance, at that period, of the experimenter, on whose claims the loud professions of the Sawyer-Man people are now based:

"The use of a platinum as holder for the incandescent carbon conductor is fatal to the durability of a lamp."—N. Y. Tribune, Jan. 2, 1880.

"The longer the pencil the more current required."—N. Y. Tribune, Jan. 2, 1880.

"To place less lamps in series and more in multiple is as hazardous as to go the other way."—N. Y. Tribune, Jan. 2, 1880.

"No lamp can be practical unless of low resistance."—N. Y. Tribune, Jan. 2, 1880.

"Notwithstanding the assertion that one of Mr. Edison's electric lamps has been running 240 hours, I still assert, and am prepared to back up my assertion, that Mr. Edison cannot run one of his lamps up to the light of a single gas jet (to be more definite, let us call it twelve candle power) for more than three hours."—N. Y. Sun, Jan. 5, 1880.

"Mr. Edison has not yet learned that the greater the resistance of a lamp the greater the power required to operate it."—N. Y. Tribune, Mar. 26, 1880.

But Mr. Sawyer could not always remain blind to Edison's success; he lived long enough to show the better side of his nature by writing a fairly unbiased account of the history of incandescent electric lighting in his book published in 1881, and entitled "Electric Lighting by Incandescence, and Its Application to Interior Illumination." He indulged in this work his higher literary taste, and undoubtedly intended it as a monument to his sincerest convictions. He says (page 71):

"The Sawyer-Man lamps, as exhibited in New York, were all furnished with carbons of this character (deposited carbons of peculiar shape), and to the perfection of these boat-shaped electrically formed carbons was due their comparative success. To the necessity of frequent renewal and the time and skill required to produce the carbons was due the commercial failure of these lamps."

On page 88 occurs this statement:

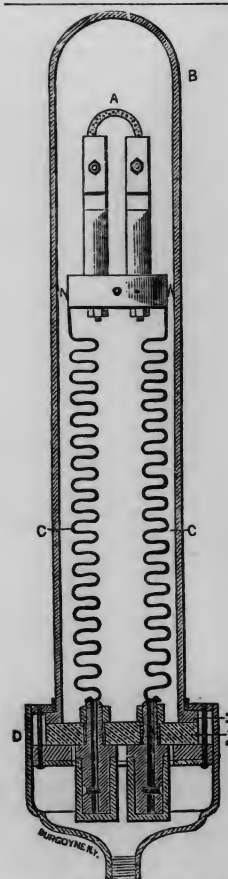
"To replace a Sawyer-Man carbon required a workman's time from two to three hours, and the re-charging of the lamp with absolutely pure nitrogen, cost about seventy cents, without taking into consideration the cost of carbon. *It was therefore an impracticable lamp.*"

The position of Sawyer and Man as inventors in the art of electric lighting, and that of their assignee, the Consolidated Company, in the commercial arena, seems to be accurately stated in an article published in "The Electrical World":

"In 1878, W. E. Sawyer, of New York, went over the ground well worn by prior electricians and produced the improvements in details that have been patented in the joint names of Sawyer and Man. He displayed great ingenuity, but was bound by the dogmas of the art, and sought for the solution of the problem of lighting by incandescence in low resistance carbons, separable globes and inert gases. He produced no new type of lamp, but confined himself to improvements in detail, useful only upon the type of lamp then well known. Some notoriety was given Sawyer's experiments by the press, but no more so than the inventions of Starr, Staite and Lodyguine received in their times and in the localities where the lamps were exhibited. Sawyer's lamp was never capable of being put into practical use.

"The facts that his experiments were contemporaneous with those of Edison, that the company incorporated to exploit them survived the time when Edison made lighting by incandescence a success, technically and commercially, and that the field promised money returns sufficiently large to dull the conscience of capitalists already out of pocket in the same direction, account for the present existence of a company which manufactures the Edison lamp and seeks to shield itself behind the Sawyer and Man patents."

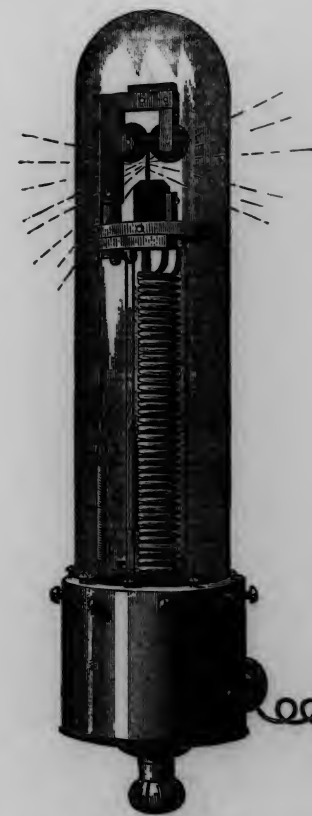
Nothing can more graphically describe the emptiness of the Sawyer-Man claims for recognition as originators of any commercial type of lamp than the views of (1) the best efforts of Sawyer in 1880, (2) the Edison or filament type the same in all essential features today as seven years ago, and (3) the present Sawyer-Man imitation thereof:



Sawyer-Man Lamp.

The Sawyer and Man Lamp, as patented by them May 12, 1885, the application for the patent having been filed January 9, 1880.

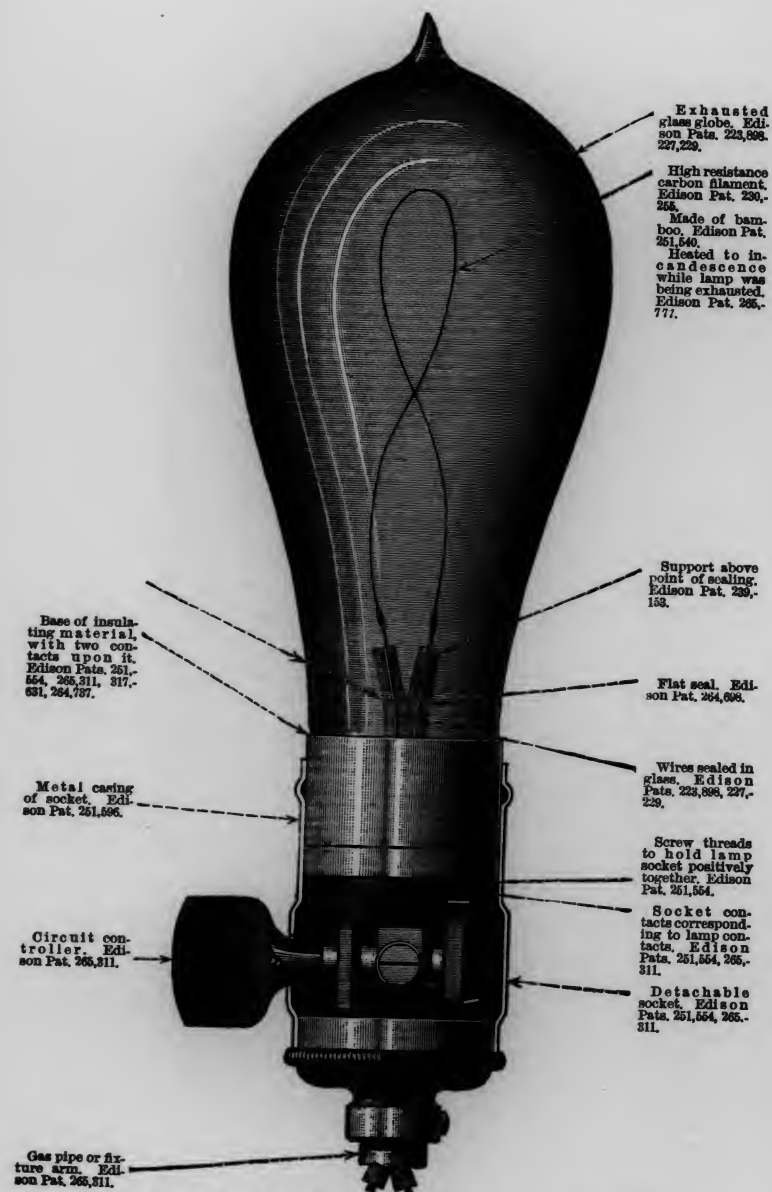
Referring to the letters on the illustration, A is a piece of carbon $\frac{1}{16}$ of an ohm in resistance; the globe B is filled with nitrogen gas, and has its base flange x clamped by rings and bolts to the plate y; the cup D is filled with wax; the conductors C C are known as "radiators," and serve to radiate the heat generated by waste of energy in the lamp.



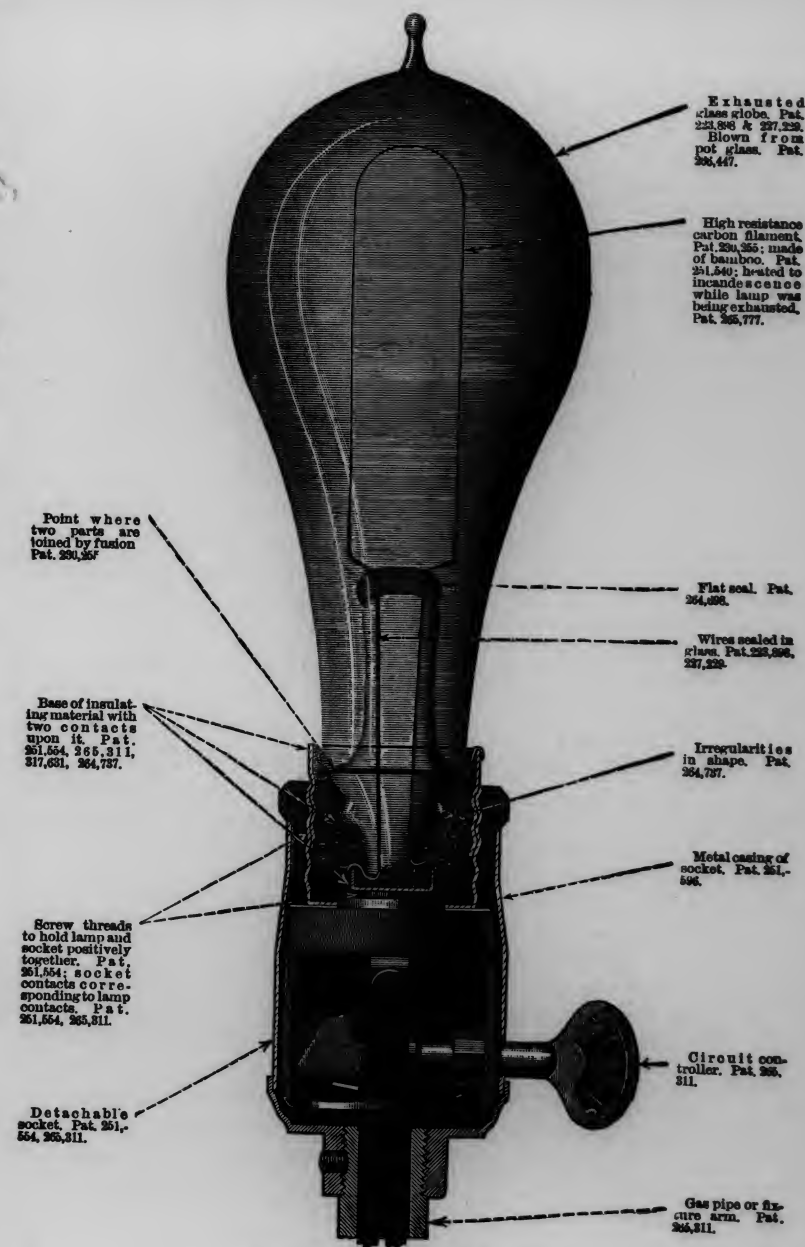
Sawyer Lamp.

After the failure of Sawyer and Man, Sawyer alone produced what he called his "feeder" lamp, shown by this cut.

This lamp has the burner of the old Werderman Lamp placed in a Sawyer and Man structure. Like the Sawyer and Man Lamp it was a failure.

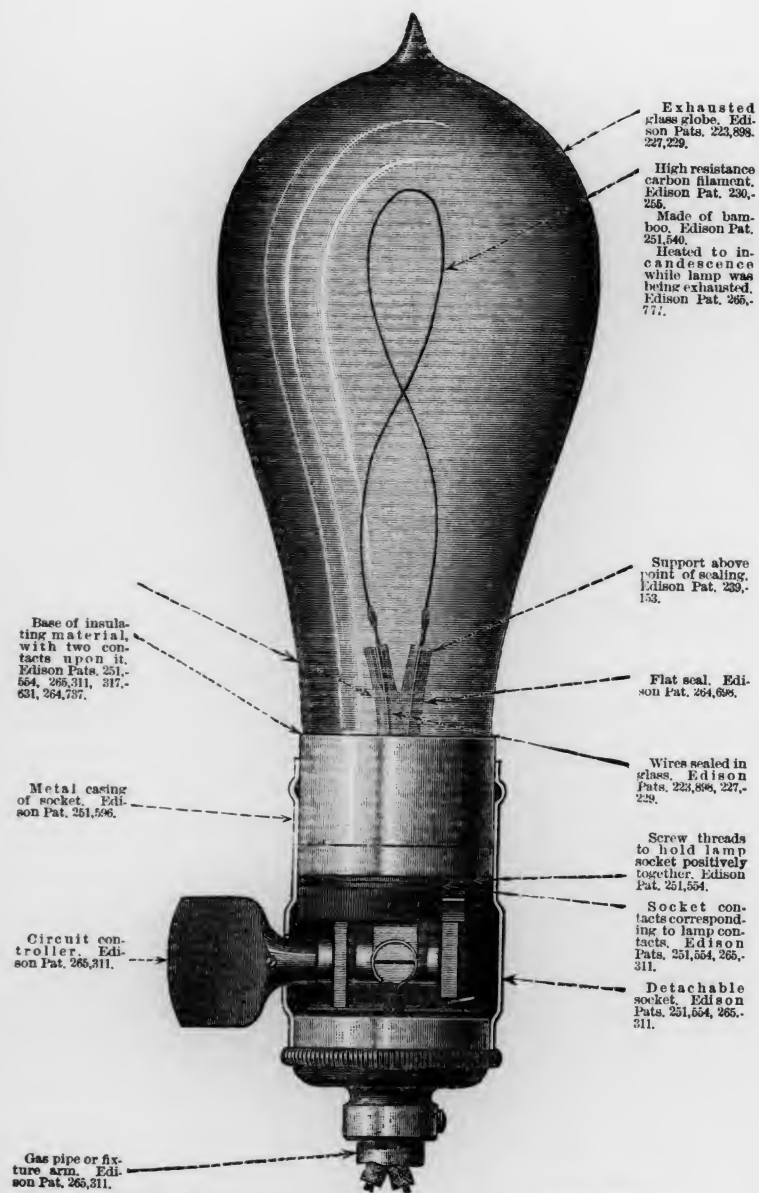


Consolidated Co. (Sawyer-Man) Infringements of the Edison Patents.

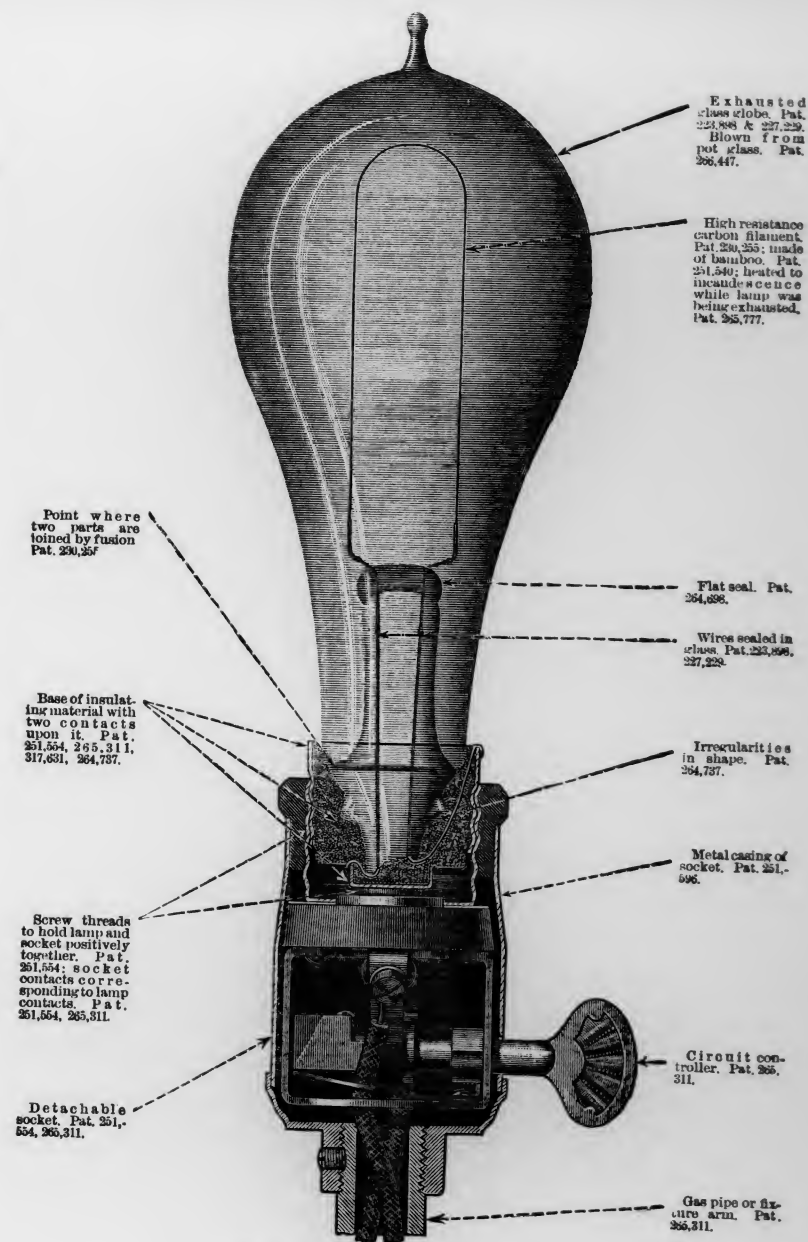


THE EDISON LAMP.

INTENTIONAL SECOND EXPOSURE



Consolidated Co. (Sawyer-Man) Infringements of the Edison Patents.



THE EDISON LAMP.

APPENDIX R.

THE WESTINGHOUSE STOCK BOOM.

One of the methods employed in booming business at the home of the company, where the stations are controlled by George Westinghouse, Jr., and operated by natural gas, is to cause the stock to be listed at a high price "asked" when no "bids" can be quoted.

For instance, in the *Pittsburgh Post* of October 12th, 1887, under the heading of "Electric Light," Westinghouse stock is given as "par 50, bid —; asked 99½." These papers are marked and distributed to prospective investors.

It would appear that even so transparent a scheme as this is dependent for bare probability upon a showing involving the use of a fuel which lavish Nature gives away.

The fact should be noted that the stock of the Philadelphia Company, with the same face value and *genuine bids*, is quoted in the same paper as below par.

One other instance, from another station, owned by the Westinghouse fraternity:

[*"Home News," New Brunswick, N. J., Plainfield, Dec. 10th, 1887.*]

Plainfield Doings.

PLAINFIELD, Dec. 10 (Special).—The Borough Council of North Plainfield last night ordered the Electric Light Company to remove its poles. This the Company refuses to do and will fight the matter in the courts. This Company is using the Thompson-Houston system with the Westinghouse Incandescent. The reason for the order to remove the poles is that the Company refused to light the streets unless the borough would take \$5,000 worth of stock. The streets are now in total darkness, but the borough will return to the oil light, procuring 170 lights for \$3,000 per year.

The method repeatedly adopted in the organization of sub-companies includes the sale of apparatus at low prices and a subsequent effort to induce local capitalists to invest in the stock of the Westinghouse Electric Co., a large amount of which Mr. Westinghouse re-

ceived for the claims brought as assets to the treasury of the present organization.

Hereby hangs a tale of widespread interest. In fact the present value of this stock, thus in process of unloading, hinges upon the very questionable "property" represented by certain United States patents acquired from Mr. Westinghouse. Let us dissect the anatomy of the organization.

In the original incorporation of the Westinghouse Electric Company, the capital (\$1,000,000), represented \$100,000 paid up in cash and \$900,000 paid Mr. Westinghouse for patents and contracts. Great sound of trumpets was made over the Stanley-Thompson inventions.

The incorporators and directors were:

Geo. Westinghouse, Jr.....	19,300 shares
C. H. Jackson.....	100 "
H. H. Westinghouse.....	100 "
John Dalzell.....	100 "
Frank L. Pope.....	100 "
John R. McGinley.....	100 "
John Caldwell.....	100 "
Robert Pitcairn.....	100 "

The par value of these shares was \$50, and Mr. Geo. Westinghouse, Jr., received 18,000 shares, full paid (!!) and non-assessable, in consideration of the transfer of the patents detailed in the charter, which was recorded in the office of the Secretary of State at Harrisburgh, Pa., Jan. 11, 1886.

The first of these, the Chinese hair carbon patent, is the oldest and probably the most valuable lamp patent of William Stanley, Jr. Its importance may be estimated from the fact that early in the business it was assigned to the Swan Incandescent Electric Light Company of Boston. Even with its aid, however, they failed of commercial results.

Many of the others represent methods long since abandoned. Three contracts also formed a part of the consideration for the \$900,000 paid Mr. Westinghouse in stock. One was with Mr. Stanley, dated May 20, 1884, and expiring Jan. 1, 1888, covering his

services "in experimenting in the field of electrical engineering, and "all inventions made therein, and letters patent secured therefor." The others were with Fairbanks, Morse & Co., of Chicago, and with Westinghouse, Church, Kerr & Co., of New York, "for the sale of "appliances to be made by the Westinghouse Electric Co." "All "the said patents and the benefits of the said contracts are stated by "the charter to be necessary for the purpose of organization and "business of this company."

The records in the office of the Secretary of the State of Pennsylvania also show how the increase of the capital stock of the Westinghouse Electric Company from \$1,000,000 to \$5,000,000 was effected.

September 15, 1886, the directors resolved to call a meeting of stockholders, and on the same day the Secretary issued the notices. October 7, 1886, the meeting convened and adjourned till November 4, 1886, when each stockholder signed a paper waiving the 60 days' notice by publication required by law of the holding of a meeting for increase of capital, and all the stock (16,110 shares) voted for the increase.

The Treasurer's certificate is here given in full :

To HON. W. S. STENGER,

Secretary of the Commonwealth :

This is to certify that by virtue of the consent of the stockholders of the Westinghouse Electric Company, authorizing an increase in the capital stock thereof from one million of dollars to five million of dollars given at an election duly held for that purpose on the 4th day of November, 1886, the capital stock has been increased from one million of dollars to five million of dollars ; said additional stock being issued as follows, viz.: for sale for cash at par, one million of dollars :

To George Westinghouse, Jr.: Three million of dollars in payment for inventions secured by Letters Patent of the United States No. 297,924, dated April 29, 1884, and Letters Patent No. 351,589, dated October 26, 1886.

[SEAL.]

JOHN CALDWELL,
Treasurer.

STATE OF PENNSYLVANIA, }
Alleghany County, } ss.:

JOHN CALDWELL, above-named, being duly sworn, says that the facts set forth in the foregoing certificate are true.

JOHN CALDWELL.

Sworn and subscribed before
me this 7th day of Janu-
ary, 1887.

WALTER D. UPTGRAFF,

[SEAL.]

Notary Public.

Filed in the office of the Secretary of the Commonwealth on the 16th day of February, A. D. 1887.

CHARLES W. STONE,
Secretary of the Commonwealth.

A certificate signed by the Deputy Secretary of the Commonwealth accompanies the copy of the returns from which the above are extracted.

Stockholders and others interested can form an opinion of whether \$3,000,000 is a just estimate of the commercial value of the two patents described in Appendix V.

Regarding the recent combination of Westinghouse, Sawyer-Man and Thomson Houston it may not be amiss to state that the Westinghouse Electric Company has purchased a controlling interest in the stock of the Consolidated Electric Light Company, the last shares being lately secured. The Westinghouse Company is thus causing the Consolidated Company to execute a series of advertising gymnastics, including the farcical purchase of the "valuable electric lampfactory and equipment at Pittsburgh," the transfer of this famed institution to New York; the concentration in the metropolis of the admiring crowd of courtiers where they can make a still greater display, and is compelling the Thomson-Houston Electric Company to dance to the same music.

APPENDIX S.

AXIOMS OF SAFETY AND TRUE ECONOMY.

Extracts from article of Thomas D. Lockwood of the American Bell Telephone Company, in the December number of the "Electrical Engineer."

"Whatever is worth doing at all is worth doing just as well as it can be done."

"As long as his delinquencies only culminated in the waste of property it was well enough to keep still; but when human life is involved (and the Cheap John himself will concede that the human form cannot, when alive, be treated with safety to a strong current of electricity), it behooves those of us who stand for the right to use our pens and tongues in protest."

"One human life outweighs all the commercial interests in the country."

"The remedy should be made compulsory, for the apostle of parsimony cannot be trusted with an option."

"Of course the moneyed man who invests is not an electrician, and he thinks the advocate of cheapness is, so he accedes to every proposition."

"All electricians who believe in the future of electricity ought to unite in a war of extermination against cheapness in applied electricity, wherever they see that it involves inefficiency and danger."

APPENDIX T.

NEWARK, N. J., December 2d, 1887.

F. S. HASTINGS, Esq., Secy. and Treas.:

DEAR SIR—I have investigated the operation of the Westinghouse station, in Trenton. An ampere diagram would show a maximum load of 98 and a minimum of 30 amperes on a recent Saturday, at noon, to Sunday, at 7:45 A. M. Assuming the correctness of their statement, that there are 20 lamps to the ampere, this shows a maximum load of 1960 lamps and a minimum of 600. As the smallest load is during the hours from 12 to 4 P. M., and from 12 P. M. to 7:45 A. M., it corroborates the general principles of the great loss of current through the converters.

This demonstrates conclusively that after the load drops to one-

third, it matters not how few lamps are in use, the consumption of current is the same, through the heavy loss in the converters.

Through the use of the 50 volt lamp a heavy loss is also sustained in the circuits of the secondary wires, and to reduce this loss the number of converters has been multiplied, so that nearly every pole has two, and some three, beside the large number that have lately been hidden behind sign-boards, and, in other cases, nailed to the buildings. In a distance of 300 feet, where not more than 100 lamps were in use, I counted seven large converters.

They have recently burned out two alternating armatures and have had part of the lights extinguished on two different occasions.

Yours, very truly,

J. W. SCHROEDER.

APPENDIX U.

There is a mine of wisdom in the few lines which we extract from a communication by Mr. Chas. Lever to the "English Electrical Review" of Oct. 31, 1885:

"As regards working arc and incandescent lights together, it is an unfortunate thing that we, in England, have already advocates and admirers of the high tension supply system. During the past two years, a system has cropped up in the United States, whereby incandescent lamps are worked on the same circuit as the arc lights by means of high tension currents. An automatic arrangement is provided with each incandescent lamp, so that in the event of said lamp giving out, a resistance equivalent thereto is thrown in circuit. It is a system which has not made much headway, and it is hoped that it never will. Notwithstanding the theoretical "bosh" which has been put forth by the advocates of the high tension system in this country, the practical electrician knows perfectly well that this is not the field to work in, if we are to make a success of our future electric light supply stations. As already stated, Mr. Edison has led the way by making his supply station in New York a practical undertaking and a commercial success. If we wish to be successful with the future electric light supply stations in this country, we should act wisely by following in his footsteps. And, when these lighting stations have developed into undertakings of any magnitude, the supply of electricity must eventually fall into the hands of the muni-

cial authorities—as in the case of gas and water undertakings—in order to secure the best results for the public benefit.”

APPENDIX V.

OTHER UNSUPPORTED CLAIMS OF THE WESTINGHOUSE COMPANY.

Some of the extravagant and often absurd claims advanced by the Westinghouse Company were taken up almost a year ago by some practical writer, not connected with any of the electric lighting companies, and handled without gloves. In his letter to the Trenton (N. J.) “Gazette,” Jan. 24, 1887, this vigorous writer says:

“An interesting document has just been jointly issued by The Fuel, Gas and Electric Engineering Company, Limited, and the Westinghouse Electric Company, setting forth their agreement not to grant exclusive control of the apparatus or methods of either, unless both are contracted with; also giving forms of agreement, prices of apparatus and other entertaining information, especially estimates of efficiency based upon twice the pressure thus far essayed by them in practice. In this manifesto one statement appears to embody the spirit of the policy—namely, that the magic of a method of limitless possibilities has at last been invoked. On page 9 the reader is startled by the revelation: ‘The alternate system of the Westinghouse Electric Company, on the contrary, is free from limitations of any nature.’ This is the literature which the long-expectant world sighs for—something untrammelled by the vexatious restrictions which Nature throws around the operation of the present methods. Evidently we have heretofore only seen through a glass, darkly.”

The same article took up the methods of the founder of this syndicate of conspirators in proclaiming the acquisition of the Gaulard & Gibbs patent:

“The cunningly-phrased announcement sent broadcast over the wires of the Associated Press has failed to immortalize the name of George H. Westinghouse, as the inventor of the vaunted system of distribution which is to-day recognized by every thoroughly-read electrician as only an *ignis fatuus*, in following which the Pittsburg company have at every step sunk deeper in the quagmire of disappointment. The enticing glimmer of this transitory will-o'-the-wisp

led them to negotiate, through a so-called “expert” agency, for an assignment of a claim then in the Patent Office. The curious coincidence of the couching of the news of their acquisition in mysterious and ambiguous language, in combination with the peculiar and unusual scarcity of the specifications of this patent, at the time of its issue, have been naturally enough widely commented upon. The fact that the electrician of the company gave some months of experiment to the system in an isolated locality, without even as much as being able to tell how many lamps he got to a horse-power expended; the fact that while the company was using an exhibition in Pittsburg as a platform by which to mount to public favor, their decrepit two-wire installation in East Liberty (Pittsburg) was transmogrified into a burlesque upon Mr. Edison's three-wire system; the fact that the Gaulard and Gibbs system, covered by this assignment, has never in any instance been worked to a successful issue by the Westinghouse Company, and cannot be so worked by anybody; the fact that it is not even a fair representative of the electrical principles sought to be embodied: all these show, as if by a burst of sunlight, the ridiculous and comfortless situation of those who, lured by the fascinating gleam of this phosphorescent decoy, have by a great effort reached, not the electrical palace which their fancy has pictured, but a whited sepulchre, full of dead men's bones.”

It is instructive to glance at the exact ground covered by this much vaunted patent of Lucien Gaulard and John Dixon Gibbs—assigned to George Westinghouse, Jr.—No. 351,589, dated Oct. 26, 1886. Gaulard and Gibbs' specification says:

“We do not herein claim the connection of the converters in the line in any other arrangement than we have illustrated in the drawings.”

The drawings referred to, where they show the use of more than one converter shows them connected in series. The patent therefore covers only the series arrangement, the use of converters in multiple arc, which appears to be the only practical way, being expressly disclaimed by the alleged inventors as forming no part of their system. The claims as a whole, were refused by the primary examiner on the ground of lack of patentable novelty, but were allowed on appeal to the Board of Examiners-in-Chief only as circumscribed in the specifications by this disclaimer.

The other patent on which reliance is placed is No. 297,924. It relates simply to details of the internal construction of converters expressly stated to be operated in series. It was issued April 29, 1884.

It will be interesting for the Westinghouse enthusiast to glance at Patent No. 278,418, allowed to Mr. Edison May 29, 1883 for "translating electric currents from high to low Tensions" and to speculate as to whether, if there were any financial value to the Westinghouse claims, the Edison Company would allow a competitor to revel in undisturbed enjoyment of it.

Persistent efforts, betraying latterly the energy of desperation, have been made to show the ability of the manufacturers to run two or more Westinghouse dynamos in multiple arc (*i. e.*, feeding their current into a common system of conductors), and thus to meet one of the cardinal requirements of comprehensive central station economy. One of the the first was at Carbondale, Pa.; then at Plainfield, N. J.; then for a long time at Buffalo, N. Y., where it was at last given up and the main conductors so divided, Nov. 13, 1887, that, as at all other stations of any great capacity, it is impossible for the attendant to hazard the operation of the dynamos by throwing them accidentally together.

A letter from New Orleans, last September, describing the operation of the Westinghouse plant, says:

"Then again, they cannot run the generators in unison in the same circuit, except under very exceptional circumstances. The local electrician has been trying for months to get his machines to work together, but he has not succeeded so far. This is a source of great trouble and annoyance, and handicaps the system very heavily."

The "very exceptional circumstances" above referred to are restricted to those cases where two dynamos, each capable of carrying the entire load of lamps and also running the other dynamo as a motor, are so operated to convey a false impression. Such an arrangement has been placed at Greensburgh, Pa., where two 300-light dynamos have been used.

In consequence of this peculiar and restricting feature of these

dynamos, the Westinghouse Company has been forced to construct very large sizes, rated as high as 2,500 lamps, thus practically placing "all their eggs in one basket."

In the face of these facts, William Stanley, Jr., the experimenter whose name will go down in history as the inventor of the Chinese hair carbon (Pat. No. 269,132, issued Dec. 12, 1882), posing as the electrician of the Westinghouse Company, in an address before the American Institute of Electrical Engineers, Dec. 6, 1887, when closely questioned, stated after much hesitation:

"I think at Denver, Col., a station of 5,000 lights is run with dynamos in multiple arc, although I am not sure. The Pittsburgh station has been run in multiple arc. Our policy is not to run in multiple arc. We prefer not to."—["Electrical World," Dec. 24.]

Had Mr. Stanley been fully informed regarding his system he would have known that the Denver plant, though sold under the great necessity of this multiple operation as one of the cardinal conditions of success, has been constructed so that it cannot be thus operated, and that the station had not at the date of his address even been started. It was not put in operation for about two weeks thereafter and with less than one-third the number of lights claimed by Mr. Stanley. The accuracy of the following telegram can be easily verified: "Denver, Dec. 28. Westinghouse plant started about week ago, sixteen hundred lights operated."

APPENDIX W.

EDISON PATENTS.

We need hardly offer any comment on the list of the Edison Electric Light Company's patents which is here appended. If the patent laws of the United States represent any protection whatever to the inventor, surely these must represent such values in the detail, as well as in the fundamental principles of the industry, as will most certainly comprise a monopoly.

EDISON COMPANIES

Operate Under the Patents Enumerated Below, Granted to
MR. THOMAS A. EDISON AND OTHERS.

No.	DATE.	TITLE OF PATENT.
1 181,613	August 29, 1876.	Electric Lighting.
2 214,636	April 22, 1879.	Improvement in Electric Lights.
3 214,637	" 22, "	Improvement in Thermal Regulators.
4 218,166	August 5, "	Improvement in Magneto-electric Machines.
5 218,167	" 5, "	Improvement in Apparatus for Electric Lights.
6 218,866	" 26, "	Improvement in Electric Lighting Apparatus.
7 219,393	Sept. 9, "	Improvement in Dynamo-electric Machines.
8 219,628	" 16, "	Improvement in Electric Lights.
9 222,881	Dec. 23, "	Improvement in Magneto-electric Machines.
10 223,112	" 30, "	Method for Measuring Electricity.
11 223,898	Jan. 27, 1880.	Electric Lamp.
12 224,329	Feb. 10, "	Electric Lighting Apparatus.
13 227,226	May 4, "	Safety-conductor for Electric Lights.
14 227,227	" 4, "	Electric Light.
15 227,228	" 4, "	Electric Light.
16 227,229	" 4, "	Electric Light.
17 228,617	June 8, "	Brake for Electro-magnetic Motors.
18 230,255	July 20, "	Method of Manufacturing Electric Lamps.
19 237,732	Feb. 15, 1881.	Electric Light.
20 238,868	March 15, "	Manufacture of Carbons, Incandescent Lamps.
21 239,147	" 22, "	System of Electric Lighting.
22 239,148	" 22, "	Treating Carbons for Electric Lamps.
23 239,149	" 22, "	Incandescing Electric Lamp.
24 239,150	" 22, "	Electric Lamp.
25 239,151	" 22, "	Method of Forming Enlarged Ends on Carbon Filaments.
26 239,152	" 22, "	System of Electric Lighting.
27 239,153	" 22, "	Electric Lamp.
28 239,372	" 29, "	Testing Electric Light Carbons.
29 239,373	" 29, "	Electric Lamp.
30 239,374	" 29, "	Regulating the Generation of Electric Currents.
31 239,745	April 5, "	Electric Lamp.
32 240,678	" 26, "	Webermeter.
33 242,896	June 14, "	Incandescent Electric Lamp.
34 242,897	" 14, "	Incandescent Electric Lamp.
35 242,898	" 14, "	Magneto or Dynamo-electric Machine.
36 242,899	" 14, "	Electric Lighting.
37 242,900	" 14, "	Manufacturing Carbons for Electric Lamps.
38 242,901	" 14, "	Electric Meter.
39 248,416	Oct. 18, "	Manufacture of Carbons for Electric Lamps.
40 248,417	" 18, "	Manufacturing Carbons for Electric Lamps.
41 248,418	" 18, "	Electric Lamp.
42 248,419	" 18, "	Electric Lamp.
43 248,420	" 18, "	Fixture and Attachment for Electric Lamp.
44 248,421	" 18, "	Current Regulator for Dynamo-electric Machines.
45 248,422	" 18, "	System of Electric Lighting.
46 248,423	" 18, "	Carbonizer.

No.	DATE.	TITLE OF PATENT.
47 248,424	Oct. 18, 1881.	Fitting and Fixture for Electric Lamps.
48 248,425	" 18, "	Apparatus for Producing High Vacuums.
49 248,426	" 18, "	Apparatus for Treating Carbons.
50 248,427	" 18, "	Apparatus for Treating Carbons.
51 248,428	" 18, "	Manufacture of Incandescent Electric Lamps.
52 248,429	" 18, "	Electric Motor.
53 248,430	" 18, "	Electro-magnetic Brake.
54 248,431	" 18, "	Vacuum Apparatus.
55 248,432	" 18, "	Governor for Electric Engines.
56 248,433	" 18, "	Utilizing Electricity as a Motive Power.
57 248,434	" 18, "	Depositing Cell for Plating the Connections of Electric Lamps.
58 248,437	" 18, "	Apparatus for Treating Carbons.
59 248,565	" 18, "	Meter.
60 251,536	Dec. 27, "	Vacuum Pump.
61 251,537	" 27, "	Dynamo-electric Machine.
62 251,538	" 27, "	Electric Light.
63 251,539	" 27, "	Electric Lamp.
64 251,540	" 27, "	Carbon for Electric Lamps.
65 251,541	" 27, "	Electro-magnetic Motor.
66 251,542	" 27, "	System of Electric Lighting.
67 251,543	" 27, "	Electric Lamp.
68 251,544	" 27, "	Manufacture of Electric Lamps.
69 251,545	" 27, "	Electric Meter.
70 251,546	" 27, "	Electric Lamps.
71 251,547	" 27, "	Electric Governor.
72 251,548	" 27, "	Incandescent Electric Lamp.
73 251,549	" 27, "	Electric Lamp and the Manufacture thereof.
74 251,550	" 27, "	Magneto or Dynamo-electric Machine.
75 251,551	" 27, "	System of Electric Lighting.
76 251,552	" 27, "	Underground Conductor.
77 251,553	" 27, "	Electric Chandelier.
78 251,554	" 27, "	Electric Lamp and Socket.
79 251,555	" 27, "	Regulator for Dynamo-electric Machine.
80 251,556	" 27, "	Regulator for Dynamo-electric Machine.
81 251,557	" 27, "	Webermeter.
82 251,558	" 27, "	Webermeter.
83 251,559	" 27, "	Electrical Drop-light.
84 251,560	" 27, "	Socket for Electric Lamps.
85 253,955	Feb. 21, 1882.	Lantern for Electric and other Lights.
86 256,701	April 18, "	Combined Gas and Electric Light Fixture.
87 257,146	May 2, "	Shade-holder for Electric Lamps.
88 257,276	" 2, "	Switch for Electric Light Circuits.
89 257,277	" 2, "	Socket for Electric Lamps.
90 259,235	June 6, "	Electrical Fixture.
91 260,562	July 24, "	Switch and Indicator for Electric Lamps.
92 12,631	" 27, "	Design for an Incandescent Electric Lamp.
93 262,271	August 8, "	Combined Gas and Electric Light Fixture.
94 262,272	" 8, "	Electrical Extension Chandelier.
95 263,103	" 22, "	Electrical Chandelier.
96 263,133	" 23, "	Dynamo or Magneto-electric Machine.
97 263,134	" 23, "	Regulator for Dynamo or Magneto-electric Machines.
98 263,135	" 23, "	Electric Lamp.
99 263,136	" 23, "	Regulator for Dynamo or Magneto-electric Machines.
100 263,137	" 23, "	Electric Chandelier.
101 263,138	" 23, "	Electric Arc Light.

No.	DATE.	TITLE OF PATENT.
102 263,139	August 22, 1882.	Manufacture of Carbons for Electric Lamps.
103 263,140	" 22, "	Dynamo-electric Machine.
104 263,141	" 22, "	Straightening Carbons of Electric Incandescent Lamps.
105 263,142	" 22, "	Electrical Distribution System.
106 263,143	" 22, "	Magneto or Dynamo-electric Machine.
107 263,144	" 22, "	Mold for Carbonizing Incandescents.
108 263,145	" 22, "	Making Incandescents.
109 263,146	" 22, "	Dynamo or Magneto-electric Machine.
110 263,147	" 22, "	Vacuum Apparatus.
111 263,148	" 22, "	Dynamo or Magneto-electric Machine.
112 263,149	" 22, "	Commutator for Dynamo or Magneto-electric Machines.
113 263,150	" 22, "	Magneto or Dynamo-electric Machine.
114 263,878	Sept. 5, "	Electric Lamps.
115 264,298	" 12, "	Coupling Device for Electrical Conductors.
116 264,299	" 12, "	Connection for Electric Circuits.
117 264,642	" 19, "	Electric Distribution and Translation System.
118 264,643	" 19, "	Magneto-electric Machine.
119 264,645	" 19, "	System of Conductors for the Distribution of Electricity.
120 264,646	" 19, "	Dynamo or Magneto-electric Machine.
121 264,647	" 19, "	Dynamo or Magneto-electric Machine.
122 264,648	" 19, "	Dynamo or Magneto-electric Machine.
123 264,649	" 19, "	Dynamo or Magneto-electric Machine.
124 264,650	" 19, "	Manufacture of Incandescing Electric Lamps.
125 264,651	" 19, "	Incandescent Electric Lamp.
126 264,652	" 19, "	Incandescent Electric Lamp.
127 264,653	" 19, "	Incandescent Electric Lamp.
128 264,654	" 19, "	Incandescent Electric Lamp.
129 264,655	" 19, "	Incandescent Electric Lamp.
130 264,656	" 19, "	Incandescent Electric Lamp.
131 264,657	" 19, "	Incandescent Electric Lamp.
132 264,658	" 19, "	Regulator for Dynamo-electric Machines.
133 264,659	" 19, "	Regulator for Dynamo-electric Machines.
134 264,660	" 19, "	Regulator for Dynamo-electric Machines.
135 264,661	" 19, "	Regulator for Dynamo-electric Machines.
136 264,662	" 19, "	Regulator for Dynamo-electric Machines.
137 264,663	" 19, "	Regulator for Dynamo-electric Machines.
138 264,664	" 19, "	Regulator for Dynamo-electric Machines.
139 264,665	" 19, "	Regulator for Dynamo-electric Machines.
140 264,666	" 19, "	Regulator for Dynamo-electric Machines.
141 264,667	" 19, "	Regulator for Dynamo-electric Machines.
142 264,668	" 19, "	Regulator for Dynamo-electric Machines.
143 264,669	" 19, "	Regulator for Dynamo-electric Machines.
144 264,670	" 19, "	Regulator for Dynamo-electric Machines.
145 264,671	" 19, "	Regulator for Dynamo-electric Machines.
146 264,672	" 19, "	Regulator for Dynamo-electric Machines.
147 264,673	" 19, "	Regulator for Dynamo-electric Machines.
148 264,698	" 19, "	Electric Lamp.
149 264,737	" 19, "	Incandescing Electric Lamp.
150 265,311	Oct. 3, "	Electric Lamps and Holders for Same.
151 265,774	" 10, "	Maintaining Temperature in Webermeters.
152 265,775	" 10, "	Electric Arc Light.
153 265,776	" 10, "	Electric Lighting System.
154 265,777	" 10, "	Treating Carbons for Electric Lamps.
155 265,779	" 10, "	Regulator for Dynamo-electric Machines.
156 265,780	" 10, "	Regulator for Dynamo-electric Machines.

No.	DATE.	TITLE OF PATENT.
157 265,781	Oct. 10, 1882.	Regulator for Dynamo-electric Machines.
158 265,782	" 10, "	Regulator for Dynamo-electric Machines.
159 265,783	" 10, "	Regulator for Dynamo-electric Machines.
160 265,784	" 10, "	Regulator for Dynamo-electric Machines.
161 265,785	" 10, "	Dynamo-electric Machine.
162 265,786	" 10, "	Apparatus for the Electrical Transmission of Power.
163 265,858	" 10, "	Regulator for Dynamo-electric Machines.
164 265,859	" 10, "	Regulator for Dynamo-electric Machines.
165 266,447	" 24, "	Electric Incandescent Lamps.
166 266,483	" 24, "	Conductors and Junctions, System of Distribution.
167 266,549	" 24, "	Electrical Fixture.
168 266,550	" 24, "	Electric Light Chandelier.
169 266,588	" 24, "	Vacuum Apparatus.
170 266,793	" 31, "	Electrical Distribution Systems.
171 266,808	" 31, "	Safety-catch.
172 268,205	Nov. 28, "	Dynamo or Magneto-electric Machines.
173 268,206	" 28, "	Incandescing Electric Lamps.
174 271,613	Feb. 6, 1883.	Manufacture of Incandescing Electric Lamps.
175 271,614	" 6, "	Shafting.
176 271,615	" 6, "	Governors for Dynamo-electric Machines.
177 271,616	" 6, "	Regulators for Dynamo-electric Machines.
178 271,628	" 6, "	Secondary Batteries.
179 271,654	" 6, "	Regulators for Dynamo-electric Machines.
180 272,169	" 13, "	Extension Electroliter.
181 273,485	March 6, "	Incandescing Electric Lamps.
182 273,486	" 6, "	Incandescing Electric Lamps.
183 273,487	" 6, "	Regulators for Dynamo-electric Machines.
184 273,488	" 6, "	Regulators for Dynamo-electric Machines.
185 273,491	" 6, "	Regulators for Driving Engines of Electrical Generators.
186 273,492	" 6, "	Secondary Batteries.
187 273,493	" 6, "	Valve-gear for Electrical Generator-engines.
188 273,828	" 13, "	System of Underground Conductors for Electrical Distribution.
189 273,859	" 13, "	Junctions for Electric Conductors.
190 274,290	" 20, "	Systems of Electrical Distribution.
191 274,291	" 20, "	Molds for Carbonizing.
192 274,292	" 20, "	Secondary Batteries.
193 274,293	" 20, "	Electric Lamps.
194 274,294	" 20, "	Incandescing Electric Lamps.
195 274,295	" 20, "	Incandescing Electric Lamps.
196 274,296	" 20, "	The Manufacture of Incandescents.
197 275,612	April 10, "	Manufacture of Incandescing Electric Lamps.
198 275,613	" 10, "	Incandescing Electric Lamps.
199 275,748	" 10, "	Flexible Electric Conductor.
200 275,749	" 10, "	Connection for Electric Light Fixtures.
201 275,776	" 10, "	Underground Electric Conductor.
202 276,232	" 24, "	Means for Operating and Regulating Electrical Generators.
203 276,233	" 24, "	Electrical Generators and Motors.
204 13,940	May 29, "	Design for Incandescing Electric Lamps.
205 278,413	" 29, "	Regulator for Dynamo-electric Machine.
206 278,414	" 29, "	Regulator for Dynamo-electric Machine.
207 278,415	" 29, "	Manufacturing of Incandescing Electric Lamps.
208 278,416	" 29, "	Manufacturing of Incandescing Electric Lamps.
209 278,417	" 29, "	Manufacturing of Incandescing Electric Lamps.

No.	DATE.	TITLE OF PATENT.
210 278,418	May 29, 1883.	Apparatus for Translating Electric Currents from High to Low Tension.
211 278,419	" 29, "	Dynamo-electric Machine.
212 278,465	" 29, "	Support for Electric Light Conductor.
213 278,535	" 29, "	System of Electrical Distribution.
214 280,563	July 3, "	Electrical Measuring Apparatus.
215 280,727	" 3, "	System of Electrical Distribution.
216 281,349	" 17, "	Regulator for Dynamo-electric Machines.
217 281,350	" 17, "	Regulator for Dynamo-electric Machines.
218 281,351	" 17, "	Electrical Generator.
219 281,352	" 17, "	Webermeter.
220 281,353	" 17, "	Dynamo-electric Machine.
221 281,576	" 17, "	Safety-catch for Electric Light Circuits.
222 283,270	August 14, "	Incandescent Electric Lamp.
223 283,983	" 28, "	System of Electrical Distribution.
224 283,984	" 28, "	System of Electrical Distribution.
225 283,985	" 28, "	System of Electrical Distribution.
226 283,986	" 28, "	System of Electrical Distribution.
227 286,350	Oct. 9, "	Electric Stand Lamp.
228 287,501	" 30, "	Electrical Testing.
229 287,511	" 30, "	Electric Regulator.
230 287,512	" 30, "	Dynamo-electric Machine.
231 287,513	" 30, "	Dynamo-electric Machine.
232 287,514	" 30, "	Dynamo-electric Machine.
233 287,515	" 30, "	System of Electrical Distribution.
234 287,516	" 30, "	System of Electrical Distribution.
235 287,517	" 30, "	System of Electrical Distribution.
236 287,518	" 30, "	Manufacturing Incandescent Electric Lamps.
237 287,519	" 30, "	Incandescent Electric Lamp.
238 287,520	" 30, "	Incandescent Conductor for Electric Lamps.
239 287,521	" 30, "	Dynamo-electric Machine.
240 287,522	" 30, "	Mold for Carbonizing.
241 287,523	" 30, "	Dynamo-electric Machine.
242 287,524	" 30, "	Regulator for Dynamo-electric Machine.
243 287,525	" 30, "	Regulator for Systems of Electric Distribution.
244 287,532	" 30, "	Junction for Electrical Conductors.
245 287,533	" 30, "	Safety-catch for Electric Circuits.
246 288,318	Nov. 13, "	Regulator for Dynamo-electric Machine.
247 288,454	" 13, "	Machine for Electric Conductor.
248 289,837	Dec. 11, "	Manufacture of Electric Lamps.
249 289,838	" 11, "	Manufacture of Electric Lamps.
250 293,432	Feb. 12, 1884.	Electrical Generator or Motor.
251 293,434	" 12, "	Incandescent Electric Lamp.
252 293,435	" 12, "	Electrical Meter.
253 293,552	" 12, "	Socket for Electric Lamps.
254 293,553	" 12, "	Combined Gas and Electric Light Fixture.
255 293,879	" 19, "	Manufacture of Electric Lamps.
256 294,697	March 4, "	Combined Gas and Electric Light Fixture.
257 295,398	" 18, "	Manufacture of Electric Lamps.
258 296,185	April 1, "	Electrical Conductor.
259 297,269	" 22, "	Electric Light Fixture.
260 297,580	" 29, "	Electric Arc Lights.
261 297,581	" 29, "	Incandescent Electric Lamp.
262 297,582	" 29, "	Dynamo-electric Machine.
263 297,583	" 29, "	Dynamo-electric Machine.
264 297,584	" 29, "	Dynamo-electric Machine.
265 297,585	" 29, "	Incandescent Conductor for Electric Lamps.
266 297,586	" 19, "	Electrical Conductor.

No.	DATE.	TITLE OF PATENT.
267 297,587	April 29, 1884.	Dynamo-electric Machine.
268 298,658	May 13, "	Socket for Incandescent Electric Lamps.
269 298,679	" 13, "	Treating Carbons for Electric Lights.
270 298,954	" 20, "	Dynamo-electric Machine.
271 298,955	" 20, "	Dynamo-electric Machine.
272 298,956	" 20, "	Operating Dynamo-electric Machines.
273 304,082	August 26, "	Electrical Meter.
274 304,083	" 26, "	Dynamo-electric Machine.
275 304,084	" 26, "	Device for Protecting Electric Light Systems from Lightning.
276 304,085	" 26, "	System of Electrical Distribution.
277 304,086	" 26, "	Incandescent Electric Lamp.
278 304,087	" 26, "	Electrical Conductor.
279 305,191	Sept. 16, "	Incandescent Electric Lamp.
280 305,200	" 16, "	Reflector for Incandescent Lamp.
281 307,029	Oct. 21, "	Filament for Incandescent Lamps.
282 307,030	" 21, "	Electrical Meter.
283 307,081	" 21, "	Electrical Indicator.
284 307,879	Nov. 11, "	Combined Gas and Electric Light Fixture.
285 308,301	" 18, "	Machine for Shaving Electric Lamp Conductors.
286 308,712	" 2, "	Electric Light Fixture.
287 308,713	" 2, "	Electric Light Conductor for Structures.
288 309,167	" 9, "	Adjustable Resistance Electric Currents.
289 311,131	Jan. 20, 1885.	Shade for Electric Lamp.
290 314,582	March 21, "	Safety-catch for Electric Circuits.
291 317,610	May 12, "	Electric Lighting System and Switch.
292 317,632	" 12, "	Incandescent Electric Lamp.
293 317,633	" 12, "	Incandescent Electric Lamp.
294 317,700	" 12, "	System of Electric Distribution.
295 318,157	" 19, "	Systems of Electric Lighting.
296 319,384	June 2, "	Safety-catch Plug.
297 328,572	Oct. 20, "	Dynamo Commutator.
298 328,573	" 20, "	System of Electric Lighting.
299 328,574	" 20, "	System of Electric Lighting.
300 328,575	" 20, "	System of Electric Lighting.
301 330,244	Nov. 10, "	Regulator for Electric Lights.
302 334,853	Jan. 26, "	Mold for Carbonizing.
303 335,045	" 26, "	System of Electrical Distribution.
304 335,048	" 26, "	System of Electrical Distribution.
305 335,099	" 26, "	System of Electrical Distribution.
306 337,199	March 2, "	Extension Electroliner.
307 337,296	" 2, "	Electric Light Fixture.
308 337,336	" 2, "	Shade for Electric Lamps.
309 338,883	" 23, "	Dynamo-electric Machine.
310 339,058	" 30, "	Electrical Indicator.
311 339,279	April 6, "	System of Electrical Distribution.
312 339,298	" 6, "	Electric Switch.
313 341,644	May 11, "	Incandescent Electric Lamp.
314 341,723	" 11, "	Electrical Switch.
315 341,778	" 11, "	Incandescent Electric Lamp.
316 341,839	" 11, "	Incandescent Electric Lamp.
317 341,990	" 18, "	Dynamo-electric Machine.
318 342,751	" 25, "	Electrical Connecting Device.
319 343,087	June 1, "	Housewiring for Electric Lights.
320 343,017	" 1, "	Systems of Electrical Distribution.
321 343,371	Aug. 31, 1886.	Safety-catch.
322 351,544	Oct. 26, "	Dynamo-electric Machinery.
323 351,855	Nov. 2, "	Incandescent Electric Lamps.

	No.	DATE.	TITLE OF PATENT.
324	351,856	Nov. 2, 1886.	Incandescent Electric Lamps.
325	352,691	" 16, "	Systems of Electrical Distribution.
326	353,035	" 23, "	Systems of Electrical Distribution.
327	353,649	" 30, "	Electric Current Meters.
328	353,783	Dec. 7, "	Incandescent Electric Lamps.
329	353,915	" 7, "	Electrical Testing.
330	354,310	" 14, "	Manufacture of Carbon Conductors.
331	354,320	" 14, "	Electrical Conductors.
332	356,041	Jan. 11, 1887.	Electrical Indicators.
333	356,042	" 11, "	Electrical Indicators.
334	356,199	" 18, "	Incandescent Electric Lamps.
335	357,050	Feb. 1, "	Lightning Protectors for Electrical Conductors.
336	358,599	March 1, "	Incandescent Electric Lamps.
337	358,600	" 1, "	Incandescent Electric Lamps.
338	359,726	" 23, "	Electrical Conductors.
339	360,258	" 29, "	Dynamo-electric Machines.
340	360,259	" 29, "	Dynamo-electric Machines.
341	361,782	April 26, "	Combined Gas and Electric Light Fixture.
342	365,509	June 28, "	Incandescent Conductor for Electric Lamps.
343	365,978	July 5, "	Systems of Electrical Distribution.
344	366,173	" 5, "	Junction Boxes for Electrical Conductors.
345	366,174	" 5, "	Electrical Conductors.

OVER 1,000 CENTRAL STATION AND ISOLATED PLANTS,

Having a Capacity of more than

ONE MILLION LAMPS,

100,000 HORSE POWER.

The Central Stations alone employing over \$15,000,000 Capital.

EDISON LIGHT

AMONG THE LARGER EDISON CENTRAL STATIONS NOW UNDER
CONSTRUCTION, ARE THOSE AT

NEW YORK, PHILADELPHIA, CHICAGO, BOSTON,

~~~~~WITHE~~~~~

CAPACITIES FROM 20,000 TO 40,000 LAMPS EACH.

EDISON ELECTRIC LIGHT CO., 16 and 18 Broad Street, New York.



[illegible]

201-6503

**Printed  
In USA**

COLUMBIA UNIVERSITY



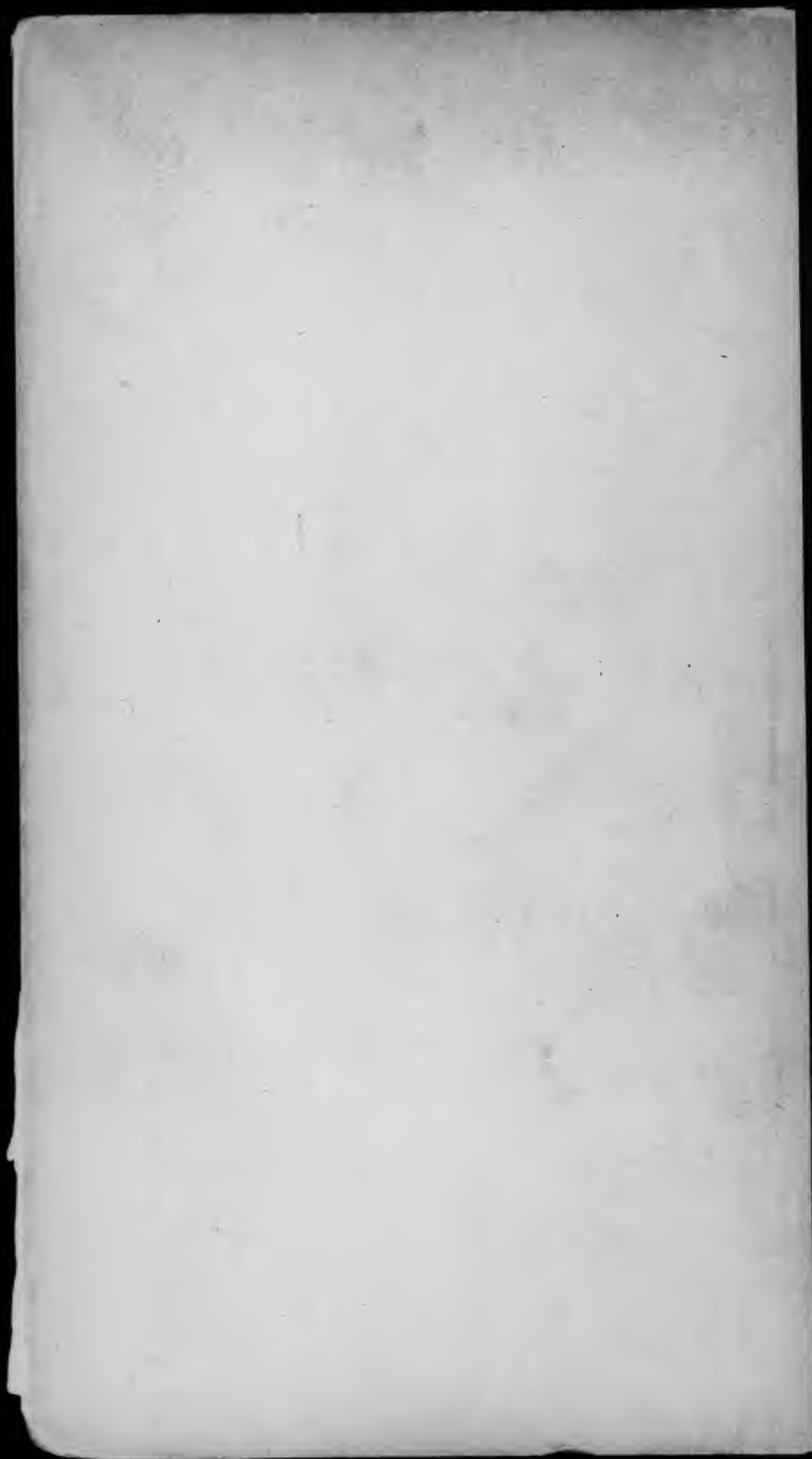
0026268990

Ed4

NEH

26 1994

IAN 7 1947



10022 - E. A.

**END OF  
TITLE**